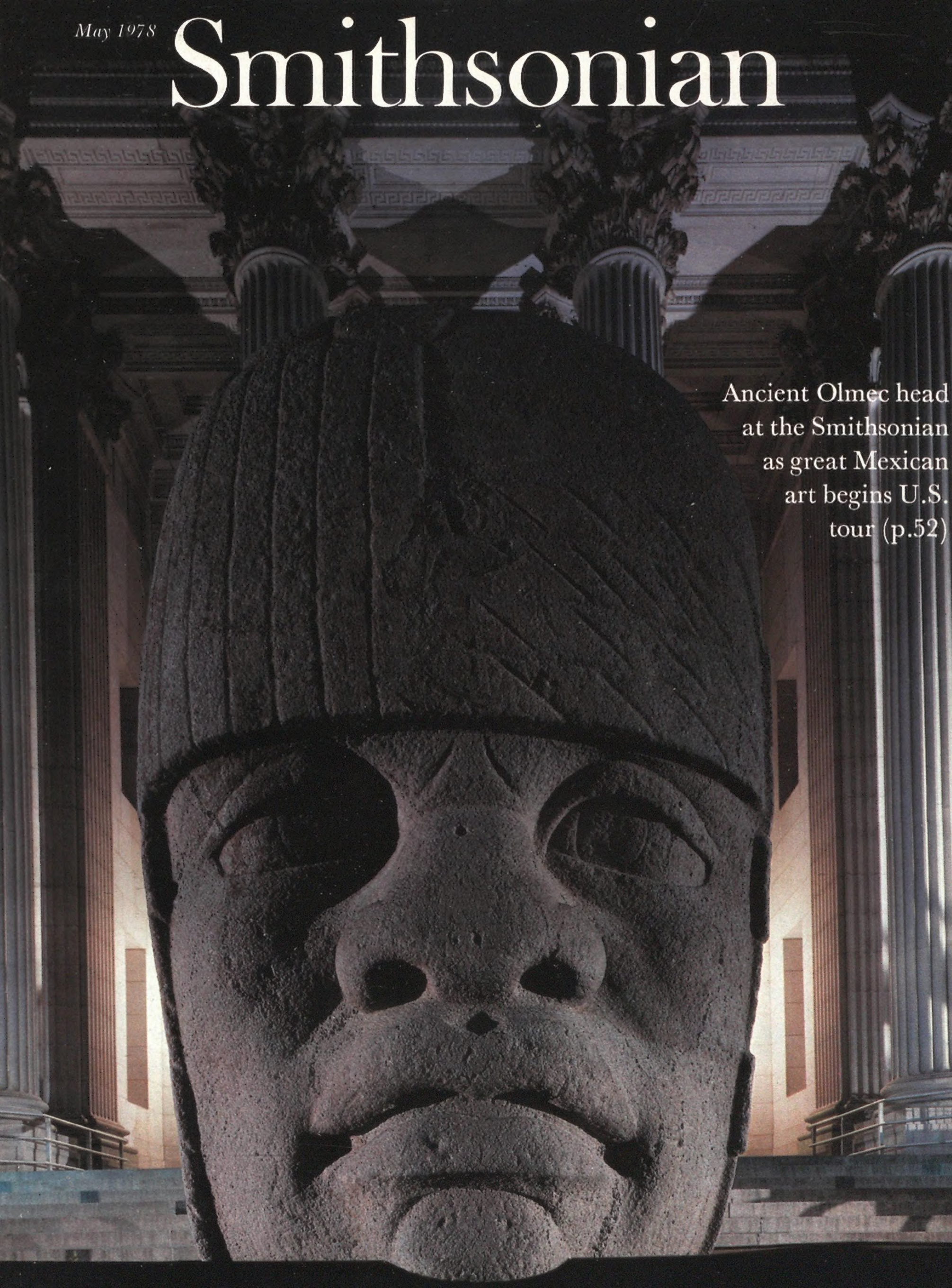
May 1978

Smithsonian



Ancient Olmec head at the Smithsonian as great Mexican art begins U.S. tour (p.52)

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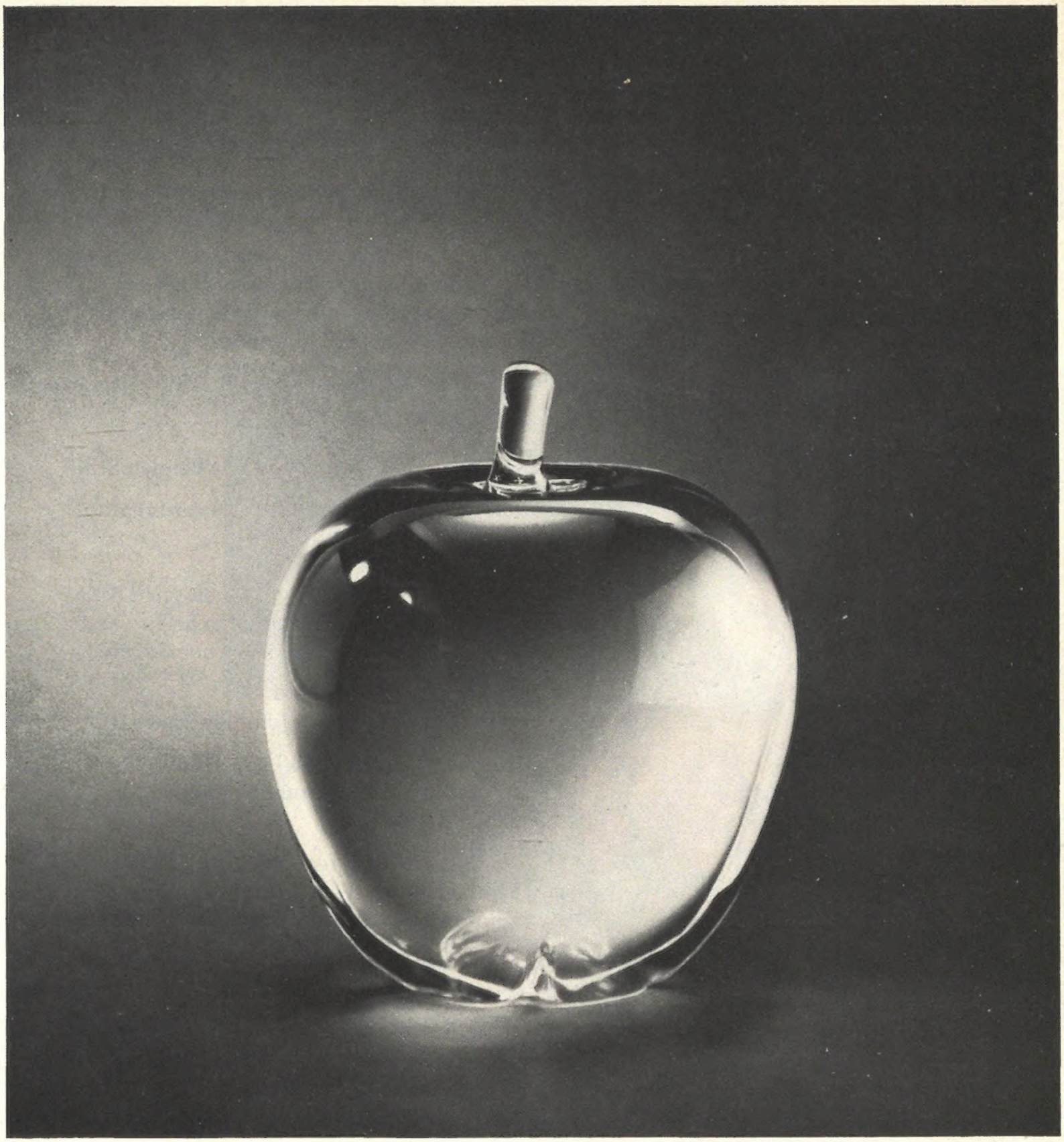

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All the photographs of sunrises in the world cannot compare to seeing one in person, off the West Coast of Maui.

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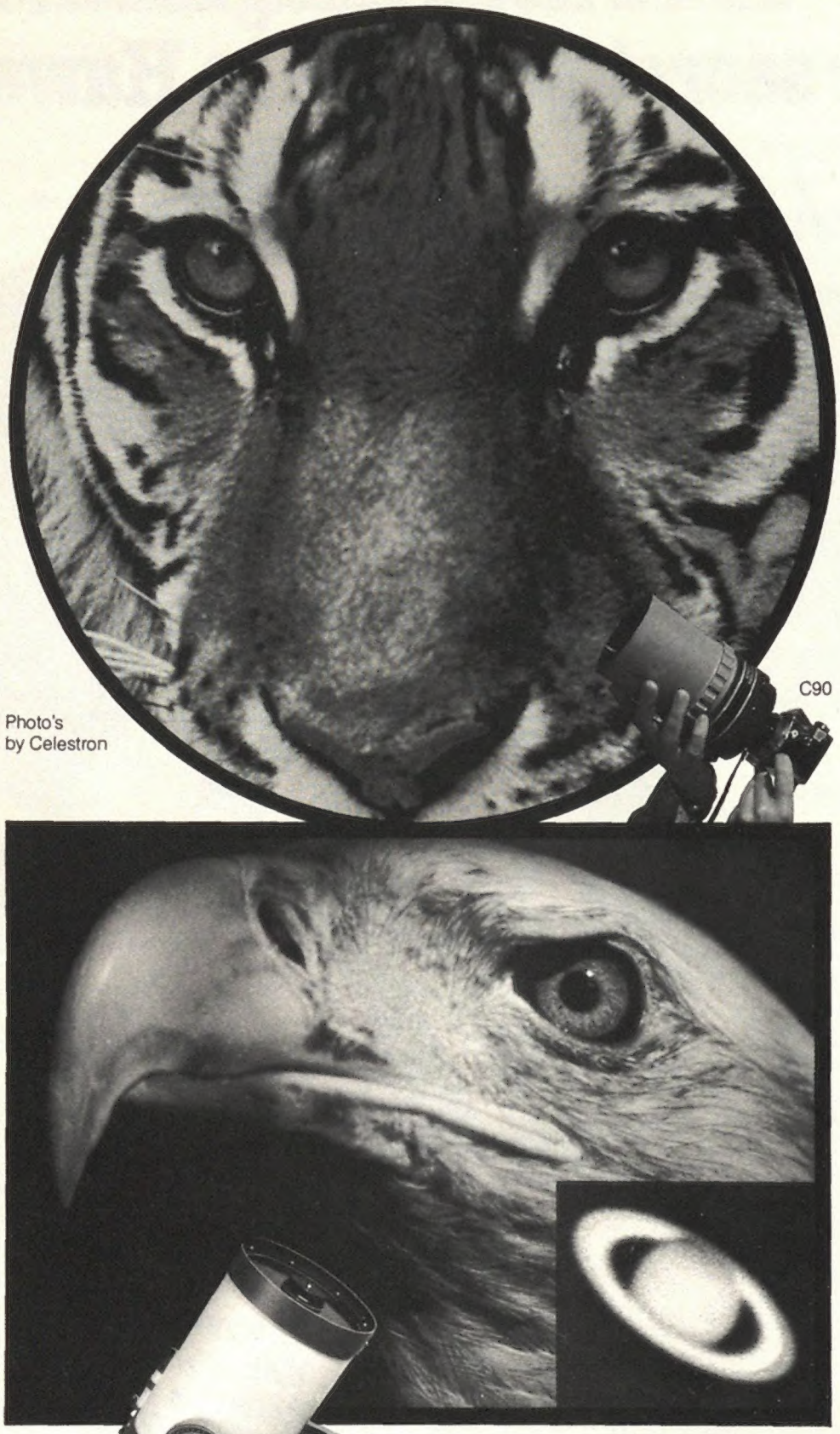

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At the Bavarian Motor Works in Munich, Germany, we reject this sedentary approach to the building of automobiles.

It is our contention that—however luxurious the accommodations—extraordinary performance is the only thing that makes an expensive car worth the money.

And so while the BMW 733i provides all the creature comforts one would expect to find in a costly European sedan—supple leather, AM/FM stereo cassette, full power accessories, etc.—it also provides a driving experience so unusual, so exhilarating it will spoil you for any other car.

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The technical genius of the BMW 733i lies not in the fact that it is—by European standards—large and luxurious.

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Its acceleration comes up smoothly with the turbine-like whine so characteristic of the electronically fuel-injected, 3.3-liter BMW engine.

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Yet much of the credit for the technical superiority of the 733i rightfully belongs to its highly innovative suspension system.

Independent on all four wheels, with a new and patented "double-pivot" front axle, it provides the driver with a tactile sense of control—an uncanny feel of the road—that belies its size and luxury.

So successfully is all this accomplished that, when you drive the BMW 733i for the first time, you will experience an almost total oneness with the car.

As the editors of Motor Trend magazine once observed, "The reaction to a BMW is always the same. The first time driver takes the wheel and after a few minutes no other automobile will ever be the same again."

If the thought of owning such a car intrigues you, call us anytime, toll-free, at 800-243-6000 (Conn. 1-800-882-6500) and we'll arrange a thorough test drive for you at your nearest BMW dealer.

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ONE OF THESE CAMERAS WAS MADE JUST FOR YOU. HERE'S HOW TO TELL WHICH ONE.

If you've considered buying a 35mm single lens reflex camera, you may have wondered how to find the right one out of the bewildering array of models and features available.

And you have good reason to wonder, since the camera you choose will have a lot to do with how creative and rewarding your photography will be.

Of course, what you pay for your camera is important. But it shouldn't be your only consideration, especially since there are very expensive cameras that won't give you some of the features you really need. So before you think about price, ask yourself how you'll be using the camera and what kind of pictures you'll be taking. Your answers could save a lot of money.

How automatic should your camera be?

Basically, there are two kinds of automatic 35mm SLR's. Both make use of advanced electronics to give you perfectly exposed pictures with point, focus and shoot simplicity. The difference is in the kind of creative control you get.

For landscapes, still lifes, portraits and the like, you'll want an *aperture-priority* camera. It lets *you* set the lens opening, while *it* sets the shutter speed automatically.

This way, you control depth-of-field. That's the area of sharpness in front of and behind your subject. Many professional photographers believe that depth-of-field is the single most important factor in creative photography.

At times you may want to control the motion of your subject for creative effect. You can do this with an aperture-priority camera by changing the lens opening until the camera sets the shutter speed necessary to freeze or blur a moving subject. Or you can use a *shutter-priority* camera, on which you set the shutter speed first and the camera sets the lens opening automatically.

Minolta makes both types of automatic camera. The Minolta XG-7 is moderately priced and offers aperture-priority automation, plus fully manual control. The Minolta XD-11 is somewhat more expensive, but it's the world's only 35mm SLR with both aperture and shutter-priority automation, plus full manual. The XD-11 is so advanced that during shutter-priority operation it will actually make exposure corrections that you fail to make.

Minolta makes all kinds of 35mm SLR's, so our main concern is that you get exactly the right camera for your needs. Whether that means the Minolta XD-11, the most advanced camera in the world. Or the easy-to-use and moderately priced Minolta XG-7. Or the very economical Minolta SR-T cameras.

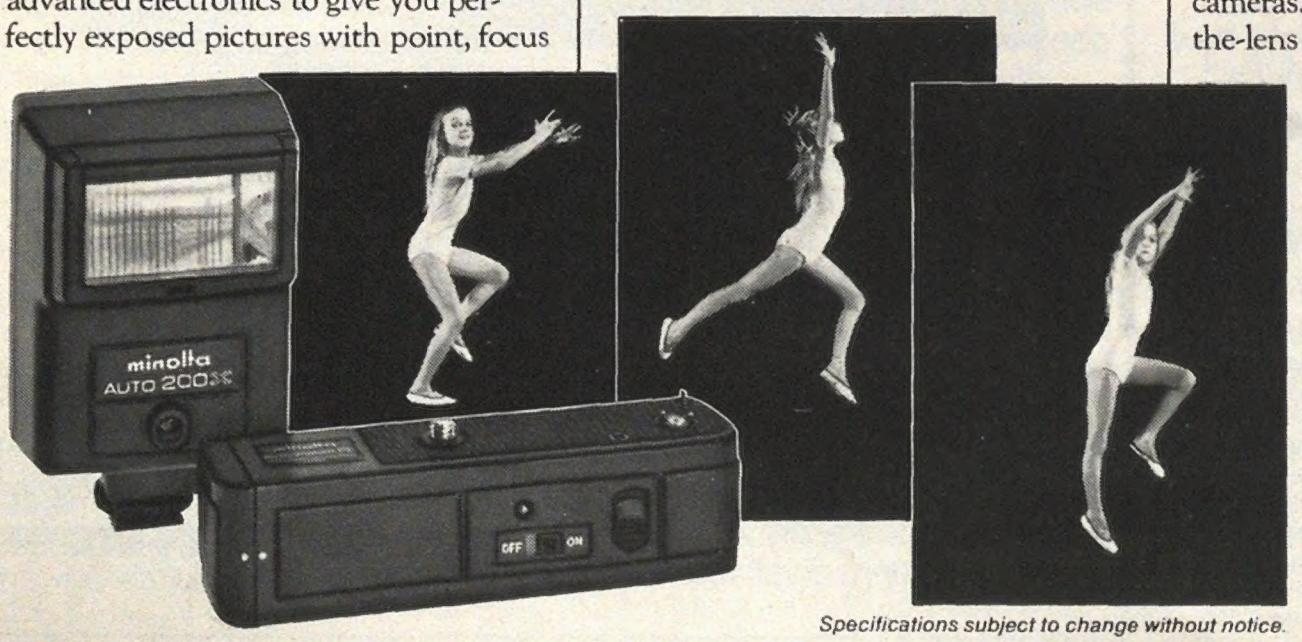
Do you really need an automatic camera?

Without a doubt, automation makes fine photography easier. But if you're willing to do some of the work yourself, you can save a lot of money and get pictures that are every bit as good.

In this case, you might consider a Minolta SR-T. These are semi-automatic cameras. They have built-in, through-the-lens metering systems that tell you exactly how to set the lens and shutter for perfect exposure. You just align two indicators in the viewfinder.

What should you expect when you look into the camera's viewfinder?

The finder should, of course, give you a clear, bright view of



Automatic sequence photography is easy when you combine a Minolta XD-11 or XG-7 with optional Auto Winder and Electroflash 200X.

Specifications subject to change without notice.

your subject. Not just in the center, but even along the edges and in the corners. All Minolta SLR's have extraordinarily bright finders, so that composing and focusing are effortless, even in dim light. And with a Minolta there's never a question about focusing. You'll find focusing aids in every Minolta viewfinder that make it easy to take critically sharp pictures.

Information is another thing you can expect to find in a well-designed viewfinder. Minolta believes that you should never have to look away from the finder in order to make camera adjustments. So everything you need to know for a perfect picture is right there in a Minolta finder.

In the Minolta XD-11 and XG-7, red light-emitting diodes tell you what lens opening or shutter speed is being set automatically and warn against under or over-exposure. In Minolta SR-T cameras, there are two pointers which come together as you adjust the lens and shutter for correct exposure.

Do you need an auto winder?

If you like the idea of sequence photography, or simply want the luxury of power assisted film advancing, an auto winder may be for you. Minolta auto winders will advance one picture at a time, or continuously at about two pictures per second. And they give you advantages not found in others, like up to 50% more pictures with a set of batteries and easy attachment to the camera without removing any caps. Optional auto winders are available for both the Minolta XD-11 and XG-7, but not for Minolta SR-T cameras.

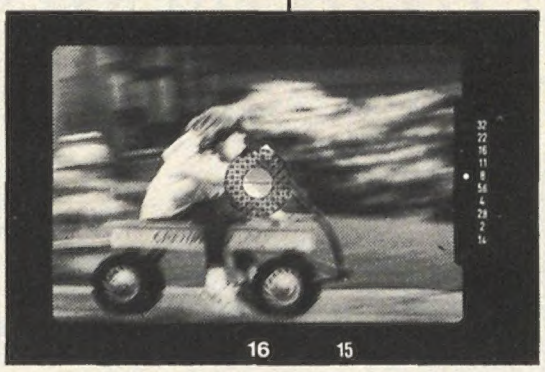
How about electronic flash?

An automatic electronic flash can be combined with any Minolta SLR for easy, just about foolproof indoor photography without the bother of flashbulbs. For the XD-11 and XG-7, Minolta makes the Auto Electroflash 200X. It sets itself automatically for correct flash exposure, and it sets the camera automatically for use with flash. An LED in the viewfinder tells when the 200X is ready to fire. Most unusual: the Auto Electroflash 200X can fire continuously in perfect synchronization with Minolta auto winders. Imagine being able to take a sequence of 36 flash pictures without ever taking your finger off the button.

You should be comfortable with your camera.

The way a camera feels in your hands and responds to your commands can make a big difference in the way you take pictures.

The match-needle viewfinder: just align two indicators for correct exposure. Because you're doing some of the work, you can save some money.



The electronic viewfinder: light emitting diodes tell you what the camera is doing automatically to give you correct exposure.

The Minolta XD-11 and XG-7, for instance, are compact, but not cramped. Lightweight, but with a solid feeling of quality. Controls are oversized and positioned so that your fingers fall naturally into place. And the electronically controlled shutters in these advanced automatic cameras are incredibly smooth and quiet.

Minolta SR-T's give you the heft and weight of a slightly larger camera, but with no sacrifice in handling convenience. As in all Minolta SLR's, "human engineering" insures smooth, effortless operation.

Are extra features important?

If you're going to use them, there are a lot of extras that can make your photography more creative and convenient. Depending on the Minolta model you choose, you can select from a number of special features. For instance, some models let you take multiple exposures with pushbutton ease (even with an auto winder). Other available extras include a window to show that film is advancing properly, a handy memo holder that holds the end of a film box to remind you of what film you're using, and a self-timer that delays the release of the shutter so you can get into your own pictures.

What about the lens system?

Just about every 35mm SLR has a lens "system." But it's important to know what the system contains. It should be big enough to satisfy your needs, not only today, but five years from today. There are almost 40 interchangeable lenses available for Minolta SLR's, ranging from 7.5mm fisheye to 1600mm super-telephoto, including macro and zoom lenses and the smallest 500mm lens in the world. And since interchangeable lenses should be easy to change, the patented Minolta bayonet mount lets you remove or attach them with less than a quarter turn.

What's next?

After you've thought about how you'll be using your camera, ask your photo dealer to let you try a Minolta. Handle the camera for yourself. Examine its features and the way Minolta has paid close attention to even the smallest details. And by all means, compare it with other cameras in its price range. You'll soon see why more Americans buy Minolta than any other brand of SLR. For literature, write Minolta Corporation, 101 Williams Dr., Ramsey, N.J. 07446.

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Secretary Ripley's comments

The view from the castle

The best person to direct a museum is not an administrative or financial expert, but someone who knows the place inside out

For years now, ever since the publication of Laurence Vail Coleman's *The Museum in America; A Critical Study* (1939), the American museum fraternity has felt itself to be a profession. People were groomed to be curators or directors or administrators, somewhat as in the disciplines of teaching. Many obtained advanced degrees, whether in art history at universities, especially those with galleries of art, or in geology, biology and anthropology.

Directors of such museums worked themselves up the hard way, usually from curatorial positions, gaining experience along the way in administration, finance and the art of acquiring objects from donors or foundations. As museums grew larger, so did the problems of administration and fiscal management. Some museums therefore hired administrators from schools of business administration or recruited them from banking or commercial enterprises. But the core remained the same: the *director* of a museum was valued for his background of experience in the daily round of curation, cataloging and acquisition. He was chosen from among his peers.

We think of this as the age of specialization. Why is it, then, that the museum profession is not taken more seriously? Recently, several museum boards of trustees, in restructuring their hierarchies, apparently have decided that a director who knows the workings inside out—from the shipping and receiving room to the finished exhibit case—does not have adequate training or experience to be the chief executive of a museum.

This train of thought perhaps follows that of some universities, whose boards have similarly considered their financial plight and sought leadership in the business community. However, that method of selecting a university president seems to be going out of fashion. A new sense of reality ordains that a president should know the inside of a university first and foremost, and that credibility with students and faculty and, finally, alumni comes from being known as a university professional.

So, too, it seems to me that museum boards should accept the fact that knowing the internal workings of a museum is the only real criterion of professional competence. How has an administrator come to be thought of as a specialist to be brought in from outside, like an automobile mechanic or a medical wizard, to diagnose the daily ills of a museum? I think it is partly because boards of trustees do not really believe in the innate skills of museum professionals. They conceive of curators as cloistered people, like monks or nuns, living in an unreal world. They cannot really credit the down-to-earth importance of what these people are doing in a worldly sense. They still feel it is not a serious career like banking or the law.

It may be, also, that professional recruiting or management advisory firms, much valued these days for their advice, fail to grasp what essentially motivates a person to seek a career in museum work. I hope that the governing boards of museums will begin to recognize, and soon, that the head of their institution should be a *trained professional*—two words that describe qualities of greater importance than many more flashy credentials.

S. Dillon Ripley

enter **Chloé**

"A woman does not put on my fragrance. She enters it."

Karl Lagerfeld

Garfinckel's

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A taste of Champagne may help you overcome your inhibitions.

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VOLKSWAGEN DOES IT AGAIN

Letters to the Editor

Violets

Dear Sir: Robert E. Cook's article, "Fragile blossoms of spring aren't shrinking violets," in the March issue was delightfully informative.

I have been observing these early fresh blooms of spring in various locations in this area for many years, and his mention of the *Viola pedata* or bird's-foot violet particularly caught my attention because Mr. Cook said that it "remains a stranger to me." The bird's-foots flourish in our open woodland by a stream. They spread their seed all over, including our stone driveway. I try to save as many as possible by transplanting them to safer locations, where they seem to thrive very well.

Thank you Robert Cook for your charming article, and Marvin Newman for your beautiful photography.
Winifred W. Hendry
Pluckemin, New Jersey

Dear Sir: I used to prowl the woods in spring to find wild violets. The first was a small, flat blue that clung close to the ground. You had to look sharp. There were clusters that grew in the pine needles with as many as a dozen blooms a plant—and one could even find the more spectacular bird's-foot violet.

Most have been rooted from my old haunts, but they still flourish in our Blue Ridge, along with the pure yellow violet, the anemone, the lady's slipper, the arbutus, the little iris and many more.

More power to those people who are trying to preserve dying breeds, whether flowers or animals.
Robina Bagwell
Spartanburg, South Carolina

Paranormal phenomena

Dear Sir: From your prestigious magazine, one would have expected something a little more pithy than Kendrick Frazier's article, headlined "UFOs, horoscopes, Bigfoot, psychics and other nonsense." Throwing distinctly different controversial subjects, such as UFO reportings, Bigfoot sightings, occult phenomena, etc., into a one-pan potpourri and presuming to give a scientific rejection en bloc to the whole scramble doomed the piece from its inception.

For example, the Bigfoot/Loch Ness class of controversy is a strictly biological one, dealing with whether or not certain biological entities have persisted in surviving (or have ever existed) to our times. A verification for the affirmative in such cases would not entail the shocking psychological and practical consequences of an affirmation that UFOs are from Outer Space. In the first case, a minute extension in the scope of biological classifications is all that would be required; in the second, a drastically different outlook on the universe and on our own lives would be involved.

You don't explain away something that has its roots embedded in mankind from the cradle of its history. If I were to make the assertion that a historical truth is first a legend, I think I would be better able to supply data arguing for the probable validity in that statement than would a protagonist for the opposite view. And surely there is more truth than poetry in Shakespeare's observation that "There are more things in heaven and earth, Horatio, Than there are dreamt of in your philosophy."
A. J. Mei
San Francisco

Dear Sir: Frazier and the SMITHSONIAN have done a great disservice to the serious researchers who have illumined the paths of paranormal inquiry for the last century by giving little more than offhand mention of their efforts. In addition, the article completely neglects to mention parapsychology's recognition today as one of the scientific disciplines.

We should have a historical perspective sufficient to prevent the denunciation of little-understood phenomena, and the derogation ("parafanatics") of those interested in such subjects. What we seem to have acquired instead is a group of self-righteous arbiters of scientific conclusions.

I suggest that both the Committee for the Scientific Investigation of Claims of the Paranormal (CSICP) and the SMITHSONIAN adopt as an emblem the bumblebee, a small monster that functions admirably without controversial explanations. Contemplation of such a symbol might accomplish much in the development of humility.
Helen I. Francis
Kensington, Maryland

Dear Sir: Philip Klass is included in your article to explain away UFOs as nothing more than disintegrating satellites, meteors or hoaxes. He has the reputation among some reputable UFO investigators of ignoring the facts. You should invite the opinions of UFO investigators such as Dr. J. Allen Hynek, head of the Center for UFO Studies in Evanston, and a technical consultant for the movie, *Close Encounters of the Third Kind.*
William R. Bury
West Palm Beach, Florida

Dear Sir: I feel insulted by articles, such as this, that imply anyone who maintains a serious attitude toward UFOs is a kook.
Frederick S. Barnaby
Woodbury, New Jersey

Dear Sir: Can we really be led to believe that the comical rivalry between James Randi and Uri Geller serves as a point for approval or disapproval of Mr. Geller's alleged powers? His refusal to submit to additional testing seems to me to be a private matter and not an indication that his alleged feats are impossible.

Who asks the CSICP to justify its existence and undergo "rigorous testing" reminiscent of the Inquisition?
Nelson J. Kari
Dixon, Illinois

Dear Sir: At one point, Mr. Frazier declares that astrology is "all a waste." Later in the article he affirms that "plants and animals, human beings included, are influenced . . . by circadian and other cycles." Astrology *is* the study of cycles, represented symbolically by the movement of planets within our solar system!

Although the field is full of contradictory theories and heated debate, with plenty of room for charlatans, it appears no more chaotic in these respects than psychology or the social sciences. My own

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interest in astrology followed ten years of increasing disillusionment with artificial intelligence, trying to teach a computer to be more like a human being. An author who classifies UFOs and the Bermuda Triangle with post-death experiences and biorhythms might stimulate research in yet another neglected area—natural stupidity.
A. E. Pottala
Adelphi, Maryland

Dear Sir: I own a bookstore and find my clientele, who are generally well educated and sophisticated, avid buyers of books dealing with the occult and paranormal and only secondarily interested in the natural sciences.

My theory is that our educational system has failed to instill in young people the understanding that science and magic are not all that different; that, indeed, science is magical. The main difference is that the scientific method allows us to measure and repeat our findings and thus find the objective answers.

What we need to do is find a way of teaching children that the leading edge of scientific research is a vast realm of the imagination where almost anything is possible, where entire worlds of amazing concepts await those inquisitive enough to pursue them.
Raven B. Earlygrow
Crow Books
Point Arena, California

Dear Sir: The author seems to be confusing the famed pediatrician *Dr.* Spock with *Mr.* Spock, science officer of the *Enterprise,* who displays a formidable amount of knowledge but so far holds no terrestrial degrees. Perhaps it's time some prestigious university bestow an honorary doctorate on our pointy-eared friend.
Carroll Kunkle
Chesapeake, Virginia

Dear Sir: You have given me hope that those who exist to profit from biased nonsense may (soon, I pray) become a dying breed. As all intelligent societies develop, there are bound to be stumbling blocks that inhibit growth. It is hoped, when after biting the dust tripping over the Gellers and others, the Fraziers, Sagans and Asimovs are there to pick us up once more.
Sue A. Millionie
Bel Air, Maryland

Dear Sir: Paranormal phenomena are fun, a relief from a hostile, aggressive world, shrinking dollar, fuel shortages, reexamination of our basic values, etc. Our beliefs, rightly or wrongly, and imagination are greater gifts for keeping mankind thriving and sane than scientific cynicism, which for all intents and purposes leaves some of us in a mental black hole. We can't prove everything, it's true, but let us have a little fun—OK?
Donald E. Roll
Ellsworth, Wisconsin

Dear Sir: I appreciated Kendrick Frazier's article as well as S. Dillon Ripley's comments on the search for truth. It is refreshing to see some of the great fads of our time put to the scientific test, and publications such as yours deserve credit for calling attention to the results. I could not help noticing, however, that the same issue carried an airline ad featuring a photograph of the "Candelabra of the Andes" and the teaser, "In Peru, you can fly across the Plains of Nazca and see the strange symbols which may have been aerial signals for astronauts thousands of years ago."

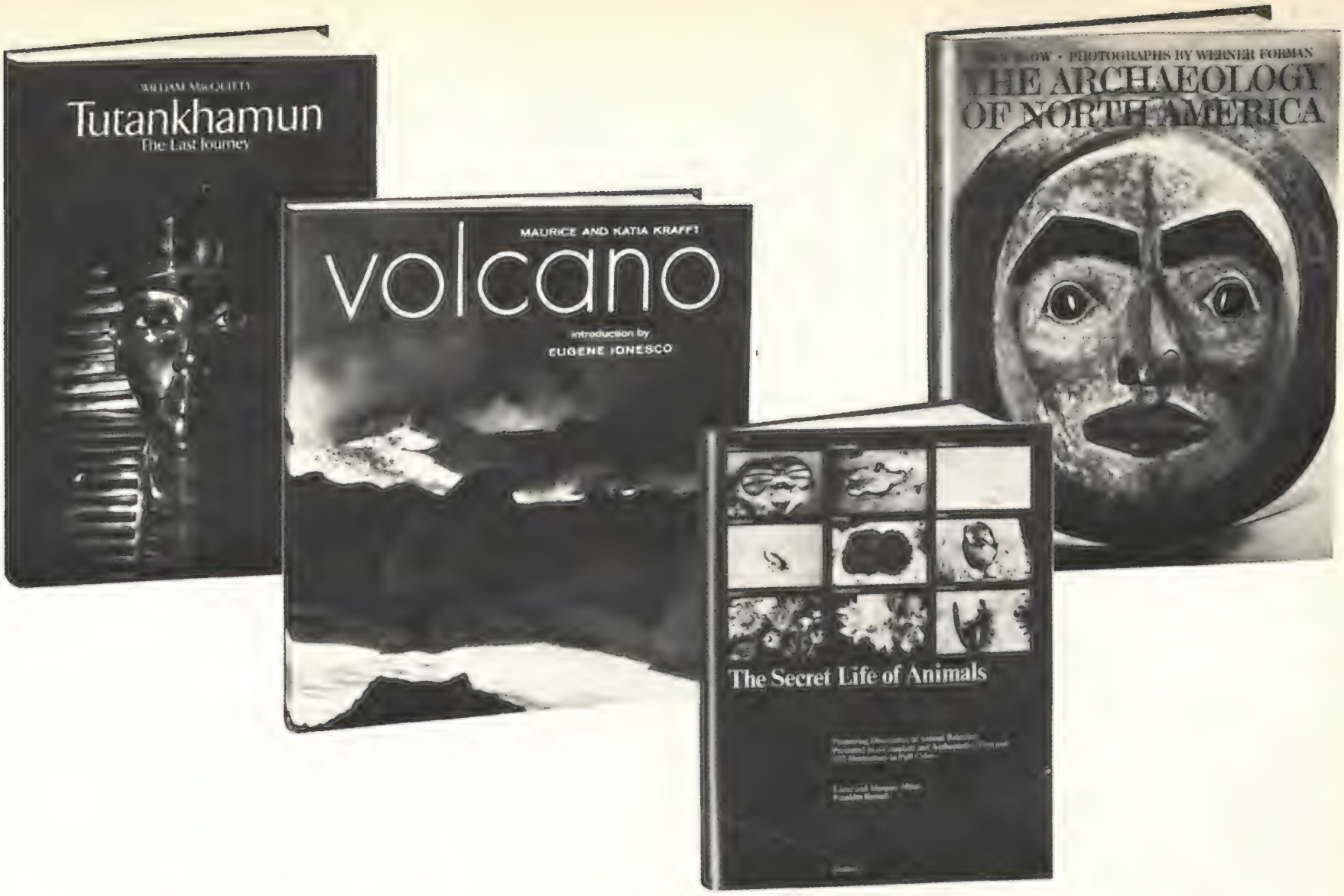
Rationality and science may try as they like, but nonsense never seems far away.
Carl Allen
Tucson, Arizona

Zoos

Dear Sir: As I was reading Sheldon Campbell's article, "Noah's Ark in tomorrow's zoo . . . ," I was bothered by one thing. Animals born and bred in captivity will never need to hunt for their food. Predators will never prowl, stalk and leap upon their prey. The smaller animals will lose their nervous alertness as they will have no enemies. In time, won't all of these animals be as uninteresting to watch as a herd of cows?
Sylvia Tillotson
Maitland, Florida

American Academy in Rome

Dear Sir: In your article on the American Academy in Rome, I believe you have misspelled the names of the Rome residents pictured at a weekly concert. They should have been identified as cellist Fran Uitti and pianist Yvar Mikhashoff.
Ben Teague
Athens, Georgia



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Ice ages may return

Dear Sir: The proposition that ice ages are now well explained by astronomical processes, which I set out in my article in January, is challenged in your March "Letters to the Editor" by William W. Blanton. He suggests that the absence of massive ice cover in Siberia and Alaska vitiates the argument. It does not.

There are two distinct questions: 1) Why do ice ages happen? and 2) What determines the pattern of ice sheets on the globe during the ice ages? My article addressed itself to the first question. The second question has to be tackled in detail in relation to terrain and to the ocean currents and winds that feed snow to the ice caps. When the Arctic Ocean is completely frozen, Siberia and northern Alaska are simply off the snow routes. Arguments about this distribution were crucial in some earlier theories concerning ice ages, but the astronomical theory is aloof from them.

Another, William King, rightly chides us for the remark that "It takes more energy to freeze water than to melt ice." That was a product of an editorial pencil, not of my typewriter.

Nigel Calder
Crawley, England

Phenomena, comment and notes

Dear Sir: I am one of those metrification "curmudgeons" James K. Page jr. mentioned. The metric system is supposed to simplify everything, but it took *National Geographic* last August eight pages to explain it, while the Book of the Month Club has offered a 32-page book to do the same. The Government Printing Office has a $2 kit prepared by the National Bureau of Standards.

I recall that when Samuel F. B. Morse launched his telegraph and the Morse Code in 1844, telegraph offices using his code multiplied quickly in the United States and Canada. But the other countries thought they knew better and altered 11 letters of the alphabet, most of the numbers and all the punctuation marks. We declined to follow suit.

Joseph B. Milgram
Brooklyn, New York

Dear Sir: I have a dear, gentle friend who had a problem similar to the one James K. Page reported—fleas. Her aged long-haired dog slept peacefully away in front of the fireplace, and every flea left the lifeless body. They took up residence in her Oriental rugs and upholstered furniture. My friend sprayed and burned smelly stuff, but to no avail.

As she was considering the expense of moving out or fumigating, she had a delightfully diabolical idea. All the neighborhood children with dogs were invited to a Puppy Party. While the youngsters were having ice cream and cake, the dogs chewed Milk Bones. When the guests left, so did the fleas.

Marian E. Needham
Lake Oswego, Oregon

Nightmare waves

Dear Sir: Peter Britton's description of the fearful storm that almost capsized the *Queen Mary* (in his February article on "Nightmare waves") brought back memories of that scary voyage. Recently, I acquired a photograph [see below] taken by the RAF in December 1942 when the *Queen Mary* was hit broadside by a gigantic wave. It was a storm that 15,000 Americans aboard that troop transport will never forget. I know. I was aboard.

Frank H. Teagle jr.
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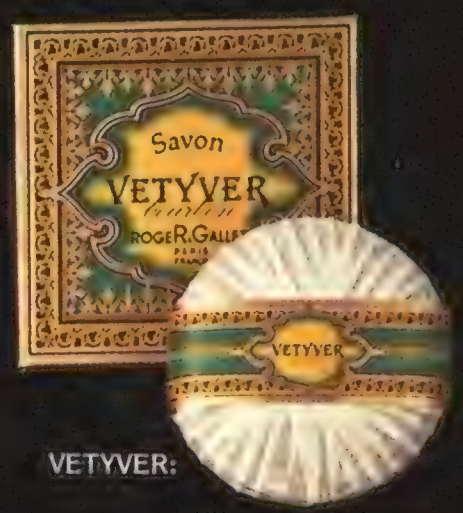

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Phenomena, comment and notes

George Babbitt and Sam Dodsworth are still on the American scene, but both they, and it, have changed

Sinclair Lewis' Sam Dodsworth and George F. Babbitt are still with us, testamentary evidence to the feeling that the best place to look for fact in character is in fiction. They have changed somewhat, of course, which means they are still alive.

And yet we have come a long way, as the country lives, since the days and daze of Babbitt and Dodsworth and their fellows, those middle-Americans of the Twenties (not bad guys, but stereotyped as Philistines).

Today, you will find them sitting on the boards of their local art commissions, steady visitors to the museums and galleries of the world, regular clients of subscription series to the theater, concert hall, opera and dance. And, not alone that, they are themselves (we will come to their children in a moment) acting in the community theater, painting, sculpting, potting, weaving, dancing, taking pictures that are more than snapshots. For it is here, in these intimate areas of the collective inner environment of the country, that our national character has been transformed. Do not, please, think of it as a "culture boom." We are not speaking of merchandising, but of one of the basic pattern-breaking changes in the history of a society—a restructuring of sensibility.

There have been changes, to be sure, in science and technology, but these were, somehow, serially predictable, differences of amount. You could (some could, anyhow) tell 50 or so years ago what was

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coming in the way of material development, those changes which do things *to* people, govern the order—and perhaps contribute to the disorder—of their days. But you could not tell what was to come in the arts and how this was to affect not only how people choose to spend their free time—those moments during which people are most what they hope to be—but, in fact, what *kind* of people they are.

Well, what kind of people are we? We will try to avoid statistics because we are not statisticians and, moreover, they frequently don't exist in this field. But, we are sitting in a busy museum at the moment (with the summer season yet to come), and we know from John R. Spencer, director of the Museum Program of the National Endowment for the Arts, that there were at least 308 million visits to museums in the country in the 1971-72 fiscal year. Spencer thinks the figure could very well be doubled by the end of 1978. The 308 million figure was estimated on the basis of the 30 percent of the nation's museums which had hard data.

Of course, it is possible here, as in other more mundane fields of endeavor, for things to get out of hand. We are thinking of a recent Associated Press story reporting that the state senate of California had approved a bill calling for a fine of up to $500 for scalping tickets. Not to the Rose Bowl, mind you, but to the sensational exhibition of King Tut's Egyptian treasures (SMITHSONIAN, November 1976) in Los Angeles.

A Gallup poll commissioned by the National Endowment for the Arts in 1971 to assess attitudes of college students toward the arts found that 35 percent of them were considering a career—as direct participant, administrator or teacher—in the arts. It is a pretty safe guess that that attitude hasn't diminished (if anything, it's probably grown). If you consider that in the fall of 1977 there were 11,360,274 college students in the United States, you come up with the formidable image of more than a third of our college population wanting, more than anything else, to spend its working years in the arts.

You could have got some sense of the vitality, quality, intelligence and imagination of those people who do live by the arts—professionals—had you stopped in at the 66th annual meeting (a four-day-long affair) of the College Art Association at the New York Hilton late last January.

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The place was as lively, as humming, as noisy as any sales convention. There were more than 6,000 participants from every state save Alaska, and what they talked about was just about every aspect and facet of art history, theory and practice that exists and is of interest to the academic art communities of the nation.

These are the people who are today and will be tomorrow teaching art and its long and complicated and life-giving history to the students of America; selecting what we see and how it is presented in the nation's museums; writing the books of theory and explication and research; staffing the galleries and administering the arts centers of the country. They are very busy, very lively and very promising. It is of no little significance to contemplate that there were 74 exhibitors, including some of the country's major publishers, manufacturers of color slides and artists' materials, who paid for space at the convention to display their wares.

And there is now, and has been for the past 13 years, an official government arts organization whose job it is to support and further the arts, no mean task.

The rise of government involvement in supporting the arts has been, after a slow-motion start, swift and accelerative, a momentum which, if not quite exponential, is nevertheless extraordinary in a nation that had for almost 200 years officially ignored or gravely condemned as either pernicious or inconsequential the idea that the arts might have something to do with an acceptable concept of what constituted civilized government.

It was not until 1962 that a President, John F. Kennedy, took notice of the situation and did something about it by appointing August Heckscher as his Special Consultant in the Arts. (George Washington had considered, as early as 1789, urging Congress to use its "best endeavors to improve the education and manners of a people; to accelerate the progress of art and science; to patronize works of Genius, to confer rewards for inventions of utility, and to cherish institutions favorable to humanity.") That belief got nowhere in terms of practice. Nor did similar feelings of Presidents John Adams, Jefferson, Madison, Monroe and John Quincy Adams, all of whom had urged the establishment of national cultural institutions and government encouragement of the arts and sciences.

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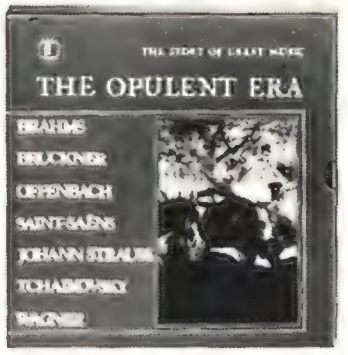

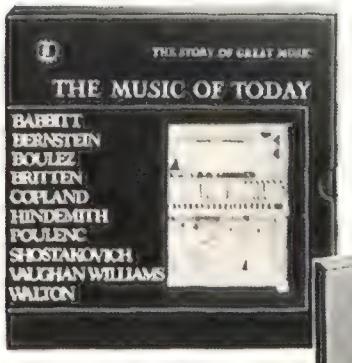

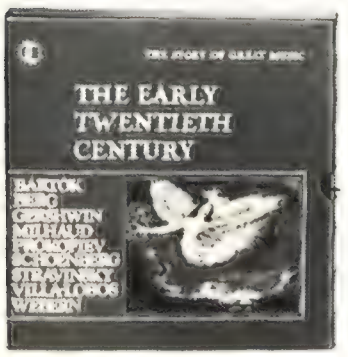

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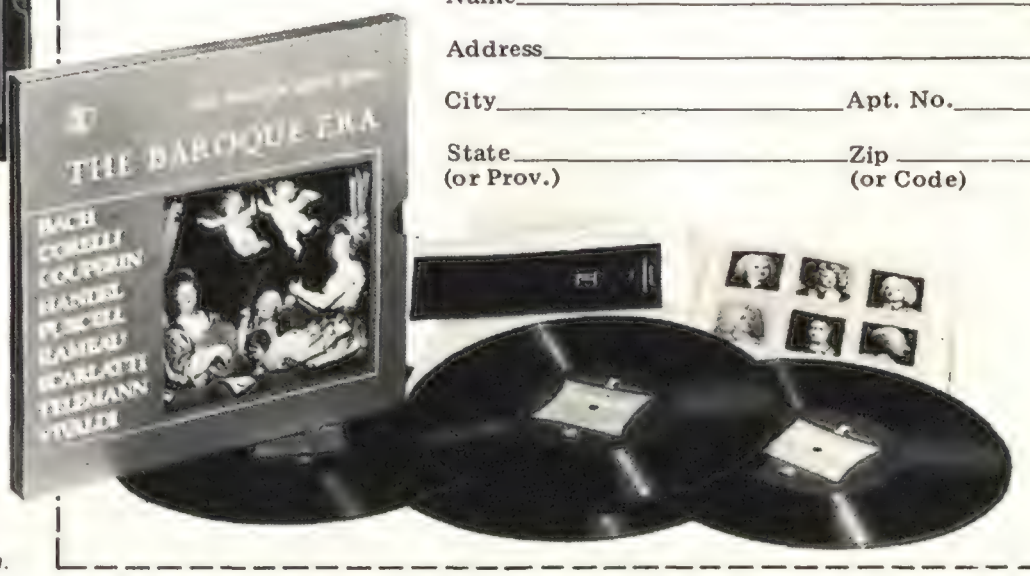

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In 1965, Lyndon B. Johnson, carrying forth yet another Kennedy-inspired program, signed the law which finally created the Arts and Humanities Endowments.

Now there are other problems.

As reflected in the Arts Endowment's budget—from $2.5 million in its first year to a proposed $150 milion for fiscal 1979—and an increasingly vocal constituency whose voting power is now apparent to both state legislators and Congressmen, there is suddenly another dimension to the change in the country.

It was inevitable, one supposes sadly, that that inherently good word "elite" should have been converted to "elitism," which becomes a dirty word. The Arts Endowment is today a bureaucracy and a good bureaucracy (that is not at all a self-contradictory set of words). A bureaucracy must serve the people. And the people, in this case in the form of local arts administrators of state and community councils, public officials, politicians and various pressure groups (oh yes, we have them in the arts, too), have got a voice. This is difficult for individual artists, scholars and professionals imperatively concerned, as they should and must be, with the highest quality and the purest art to accept. But there we are.

(Perhaps what is needed here is some wisdom of the sort that can always be found in Samuel Johnson. He wrote, for example, on the subject of Milton's politics, in *The Lives of the Poets*, that they expressed a "surly republicanism" more concerned with "levelling down" than "levelling up.")

Or perhaps it is another (I'm sorry, but it is so) very small, very select organization which could deal with the highest level of professional artistic creativity. Otherwise we are going to have a rising conflict between the "populists" and the "elitists." And, they both have good cases.

We have invented a parable for the predicament. It supposes that it was an artist who invented the wheel for the simple reason, and no other, that the shape was pleasing—and along came an engineer and revolved it. When he did that he destroyed a work of art and made a machine. Of course we need both. Hang the wheel on a wall, dangle it in the air and enjoy it for its shape alone, by all means. But, we need it to get around with, too.

Don't we?

—Bennett Schiff

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Around the Mall and beyond

As you read this, on a blossomy May morning, the Smithsonian's great California meteorite—which you may have heard about—is being, has just been, or will soon be cut to produce investigatable surfaces to further our knowledge of meteoritics. This act is being, has just been, or will soon be perpetrated on the ground floor of the Museum of Natural History by a long, tough wire saw blade which looks like a giant pipe cleaner. It moves horizontally at great speed and is lowered onto its victim by an inexorable hydraulic control stronger than Superman.

The mention of Superman brings to mind the meteorite's arrival in Washington. It had been tweaked away from its California resting place by a six-bladed Marine Corps helicopter (right), of the type known as Sea Stallion. It was then transported to Washington in a moving van, and during the last snowfall of the winter it arrived at the museum.

Your faithful reporter Clark Kent started to troop dutifully through the slush to watch the meteorite get unloaded. It weighs 6,070 pounds, so Clark was interested in how the museum would handle it.

But as he reached the Mall, Clark was suddenly surrounded by nine fire engines, all blatting angrily at him and winking their red lights balefully. They stopped in front of the castle, of all places, and burly men in helmets and yellow waterproof jackets ran inside with shiny pry bars and sharp axes.

In a flash, Clark Kent ducked into a handy mailbox and emerged as Superman, iron muscles flexing in eagerness to save the castle. In he streaked, just in time to meet all the firemen coming *out*. The Big S's mighty surge of adrenalin subsided when he realized it was a false alarm. The historic fireplace in the historic office that once was Joseph Henry's and is now occupied by Secretary Ripley (who was not there) had started smoking from an ill-vented fire built with historic coal. Someone smelled the historic smoke and pulled the alarm, which is not at all historic. In seconds, ten trucks were on the scene (one at the rear of the building) along with Superman. The Smithsonian has been well-served by the D.C. Fire Department for years, and we hate to turn in false alarms. But ever since the Smithsonian fire of 1865, staff people have been sensitive about smelling smoke.

Anyway, Superman wasn't needed at the fire, but was *almost* required to untangle the traffic jam caused by all those great snorting fire trucks trying to get past each other on narrow little Jefferson Drive. By the time they'd sorted themselves out and Big S had changed back to Clark Kent, the California meteorite had been unloaded.

The museum people reportedly got it in with a forklift. No problem. They all wanted to know what had been going on over at the castle.

Clark Kent was not long frustrated in

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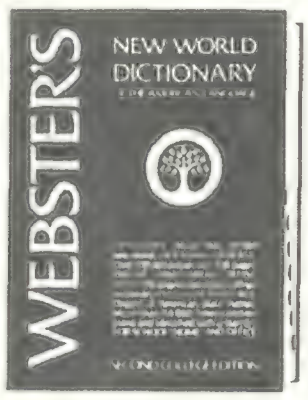

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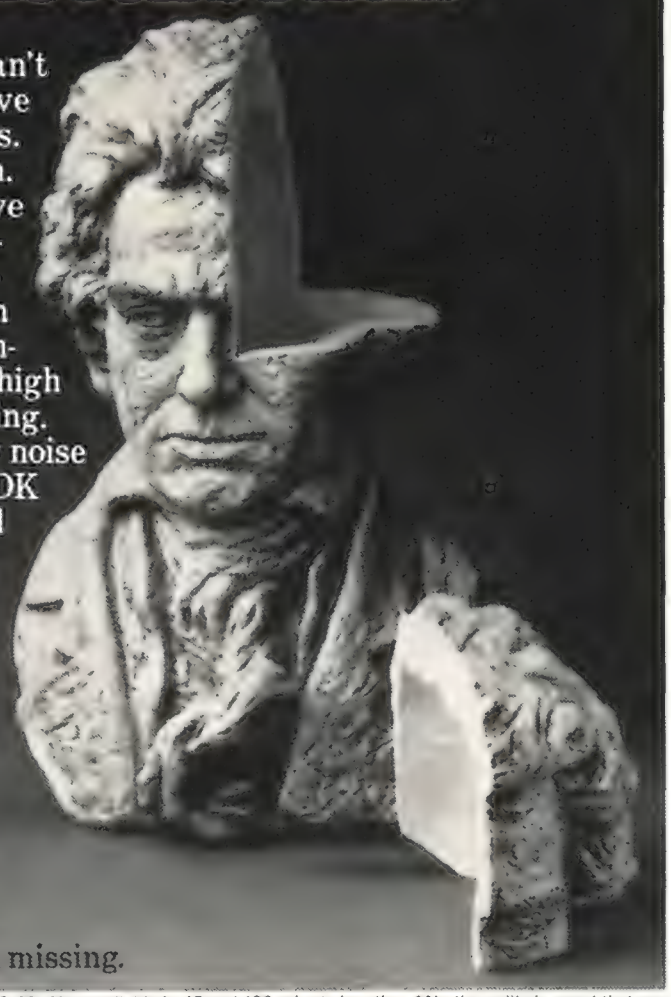

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his wish to see a great weight lowered onto the Museum of Natural History (not that he has anything against the Museum of Natural History). A few days later the great Olmec head (see cover) was put into position on the museum's front steps.

Clark reports that the head was lowered by a Bucyrus Erie 45-C crane, that it rests on a platform of I-beams topped with an unidentified squishy substance, that it is shimmed up by four-by-fours and that it weighs about six tons.

Clark also points out that one spectator was so interested that he did not even unwrap his coconut meringue pie, that eight others asked at large, and at various times, what the big rock was for, and that when the ancient Olmec face was unveiled one young man exclaimed, "My God, that's my brother!"

If the great stone face ever shakes some plaster loose into the basement rooms beneath the museum steps, it may disturb the progress of an impressive venture being carried out by the Smithsonian for publication and distribution by the Government Printing Office. This is a 20-volume encyclopedia edited by William C. Sturtevant and entitled *Handbook of North American Indians*. It has been in the planning stage since 1965, and the first completed volume came off the press last month. This is Volume 8 and deals with the Indians of the California culture area. Another volume dealing with Northeastern Indians is in production, and one on Southwestern Indians is coming along.

The California book has 72 articles by 47 authors. There are 430 illustrations and a 31-page index, which is aimed at answering the obvious questions of high school students as well as scholars.

All of the books are built around scholarly chapters that deal with tribes or language groups. These core chapters give the expert all he can want. They are supposed to be definitive, and they are. With them are a few more general chapters which sketch the whole area being covered. In the case of the California volume, there is a chapter on "The Impact of Euro-American Exploration and Settlement" in which the author, a Cahuilla Indian, tees off pretty angrily at injustices perpetrated by the whites.

Some time ago (SMITHSONIAN, March 1977) another authoritative book appeared with Institution antecedents, this

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one on rails (the birds, not the train tracks) by Secretary Ripley himself. The designer of this book, a very nice lady named Crimilda Pontes, caught my attention on a late winter day because she was engaged in conversation with a bird out in the Victorian Garden. Noticing my presence, Crimilda introduced me to Henry, a mockingbird. We exchanged amenities, and then I raised my hat and strolled on without giving the meeting much thought except that Henry seemed a nice enough bird.

Later, Crimilda sought me out to fill in the unsubstantial picture I had gained of Henry. It appears that he is an unusually feisty mockingbird with extremely well-honed territorial instincts. And since his territory consists of a corner of the Victorian Garden close under the Secretary's office (which did *not* catch fire back there in the opening paragraphs of this most confusing column), he is called Henry after Joseph Henry.

Crimilda caters to birds on snowy winter days, supplying them with raisins and bacon-fatty crumbs. Henry reports instantly when she whistles, and gathers his loot efficiently. From the first, he defended his share vigorously from the ravages of starlings, pigeons, sparrows and other tax collectors. When these jackals show up, he stands over it and vociferously drives them off. Crimilda says his langauge can get pretty rough. A lot worse, one supposes, than Secretary Henry's.

Newest major exhibit at the National Air and Space Museum, hanging right up there in the Milestones of Flight gallery,

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is the astonishing aircraft called *Gossamer Condor,* which appears as a ghostly, semi-transparent structure in the photograph below. It is the huge, fragile machine that finally captured the Kremer Prize for the first truly successful flight in a man-powered airplane. It has a wingspan of 96 feet, yet weighs only 70 pounds, being built of aluminum tubes, cardboard, pi-

ano wire, plastic wrap and occasional bits of tape to help hold it all together.

The *Gossamer Condor* achieved considerable publicity when it flew the prescribed course with no sweat except on the face of its 135-pound, hard-pedaling pilot. But I am intrigued at its similarities to the Wright plane, just in front of it, and below. Both had forward elevators; both used wing-warping to help out on turns; both had control devices far different from most other planes; both were flown by pilots who had the guts to get them off the ground and then learn how to fly them. It's nice to see things go full circle in the Milestones of Flight.

—EDWARDS PARK

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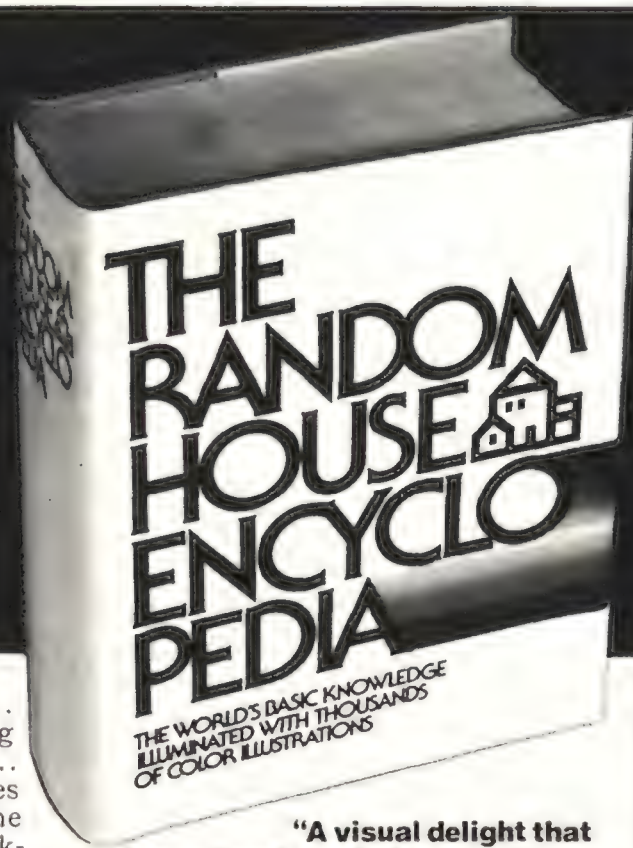

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THE NEW MONTE CARLO. IN TUNE WITH THE TIMES, APART FROM THE CROWD.

The fact that you paused at this page would seem to indicate that you have an eye for beauty.

Monte Carlo is indeed a jewel.

A sparkling combination of crisp angles and soft curves, today's Monte Carlo stands proudly apart from the crowd with a poise and personality all its own.

It is clean, contemporary, thoroughly new.

Yet it retains the class and character that have made Monte Carlo such an immensely popular personal luxury car over the years.

Now, as before, there is no other car quite like it.

Please Step Inside.

In designing The New Monte Carlo, we placed great emphasis on room and comfort.

We have actually "upsized" the interior, building into it more head room and leg room than you'd find in a 1977 Monte Carlo, both front and rear.

The back seat is surprisingly spacious and comfortable to ride in. Yes, even for adults. The increase in leg room makes a world of difference. The added head room lets you sit tall. There's even more hip room this year than last. Getting in and out is easier now, too. You'll also find more usable luggage space in the trunk this year.

The car is handsomely furnished and tastefully finished in every detail. From the pull straps on the doors to the thickly carpeted floors, everything is designed for your pleasure, your comfort, your delight.

Think of it as your personal "driver's suite." A posh and private place to call your own.

Now Set It in Motion.

Monte Carlo has always been, and continues to be, a remarkably rewarding car to drive.

Its road-tuned suspension system, with front and rear stabilizer bars plus steel-belted radial-ply tires, provides a nice feel both on straightaways and curves.

And now, with less overhang and a shorter turning diameter than last year's Monte Carlo, the car is easier to manage in cramped quarters, tight turns, parking.

An Efficient New Engine.

The New Monte Carlo is powered by an advanced V6 engine designed to provide a beautiful blend of performance and economy.

EPA mileage estimates with the standard 231 Cu. In. V6 and available automatic transmission are 27 mpg on the highway, 19 mpg in the city. Actual mileage may vary depending on how and where you drive, car's condition and available equipment. Estimates lower in California. (Monte Carlo is equipped with GM-built engines produced by various divisions. See your dealer for details.)

A 305 Cu. In. V8 is available.

Etcetera, Etcetera.

When you buy a Monte Carlo you get molded full-foam seats, dual mode interior ventilation, High Energy Ignition, a battery that never needs water, thick carpeting even under the seats, an acoustical "ceiling" that soaks up sound.

You get the "little things" as well. An electric clock. Lighted glove compartment and ashtray. Sunvisors that are shaped to stay out of your way.

The New Monte Carlo.

Genuine elegance in a car for our times.

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PUT A LITTLE DISTANCE BETWEEN YOURSELF AND THE CROWD.

"Ætna, heal thyself."

In recent months, Ætna has been blunt in criticizing some expensive flaws in America's health care system.

Our bluntness has brought us, in return, equally blunt criticism of ourselves:

A hospital administrator from Illinois says that Ætna's *own*

insurance plans have encouraged overuse of hospitals—since we pay for some procedures only when the insured person is hospitalized, even though out-patient treatment might cost less. (He's right. Some plans do this. We need to work harder to change them.[1])

Several doctors asked how we could claim to "give consumers a stake in holding down costs" when we're still selling health insurance that has little or no deductible.[2]

Another physician says that skyrocketing malpractice insurance premiums have forced him to increase the charges to his patients.[3]

Another accuses Ætna of "scapegoatism" and "kicking the dog," and a hospital representative contends "you attack us."[4]

To these last charges we plead "not guilty." Our criticism is aimed at the *health care system* and not at doctors or hospitals—although all participants (including Ætna) must share some responsibility. Most worthwhile changes in society bring with them strong disagreements and public debate. Slowing the runaway costs of this system needs open discussion now. Ætna will keep focusing on the flaws we see. And we'll keep welcoming—and responding to—the views of those who disagree with us most strongly.

Ætna wants insurance to be affordable.

[1]In the last few years we've intensified our efforts to correct this imbalance: Ætna health insurance plans are covering more and more kinds of out-patient care. Examples: Post-hospital convalescent facilities (since 1969); free-standing ambulatory surgical centers (since 1973); pre-admission testing (experimentally since 1970—now being extended nationally); and post-hospital home health care already available in many plans.

[2]This is also true. Although Ætna has been stressing the value of deductibles and co-insurance since the mid-1950's, the physicians' criticism is fair: we *are* still writing insurance plans that have no deductibles for hospital charges. The pressure to "give the customer what he wants" is a constant in business. Ætna, like most insurers, has given in to it too many times when it may not have been in society's long-term interest.

[3]An increase, starting in the early 1970's, in the number and size of liability suits caught insurers by surprise, and drastically forced up premiums to cover legal costs, court awards and out-of-court settlements. Part of the solution, Ætna believes, is to reform an increasingly *dis*-torted tort law system. This is a subject as controversial and important as the health care system itself.

[4]In response to our earlier advertisements, several doctors wrote along these lines: "Ætna, being a large company, can afford to take pages in national magazines and push its opinions; I, as a private practitioner of medicine, obviously cannot." This advertisement is a recognition of that point of view. But we don't think that any of us involved in the health care system can afford to overlook our own contribution to the problem. Each of us should give some criticism, take some—*and act on it.*

Ætna
LIFE & CASUALTY

Ætna Life & Casualty,
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By Carl Sagan

The quest for intelligent life in space is just beginning

Intelligent life on Mars was once thought likely, but Viking spacecraft found no unambiguous proof of life, though they gathered soil samples and took photographs, including sunset picture above, enhanced to produce color version (at right). Thus, the question of some life on Mars remains open.

Director of Cornell's Laboratory for Planetary Studies, Professor Sagan is a widely known commentator on the relationship between Man and cosmos. His new book: The Dragons of Eden.

New advances in radiotelescope design and data analysis make possible a search for other civilizations in our Galaxy

Through all of our history we have pondered the stars and mused whether mankind is unique or if, somewhere else out there in the dark of the night sky, there are other beings who contemplate and wonder as we do, fellow thinkers in the cosmos. Such beings might view themselves and the universe differently. Somewhere else there might exist exotic biologies, technologies and societies. What a splendid perspective contact with a profoundly different civilization might provide! In a cosmic setting vast and old beyond ordinary human understanding we are a little lonely, and we ponder the ultimate significance, if any, of our tiny but exquisite blue planet, the Earth. The search for extraterrestrial intelligence (SETI) is the search for a generally acceptable cosmic context for the human species. In the deepest sense the search for extraterrestrial intelligence is a search for ourselves.

Until recently there could be no such search. No matter how deep the concern or how dedicated the effort, human beings could not scratch the surface of the problem. But in the last few years—in one millionth of the lifetime of our species on this planet—we have achieved an extraordinary technological capability which enables us to seek out unimaginably distant civilizations, even if they are no more advanced than we. That capability is called radio astronomy and involves single radio telescopes, collections or arrays of radio telescopes, sensitive radio detectors, advanced computers for processing received data, and the imagination and skill of dedicated scientists. Radio astronomy has, in the last decade, opened a new window on the physical universe. It may also, if we are wise enough to make the effort, cast a brilliant light on the biological universe.

Some scientists working on the question of extraterrestrial intelligence, myself among them, have attempted to estimate the number of advanced technical civilizations in the Milky Way galaxy—that is, societies capable of radio astronomy. Such estimates are little better than guesses. They require assigning numerical values to quantities such as the numbers and ages of stars, which we know well; the abundance

A gold-plated phonograph record is attached to Voyager 2. If spacecraft is ever intercepted by aliens, they will hear sounds of classical and rock music, a kiss, whales, human conversation.

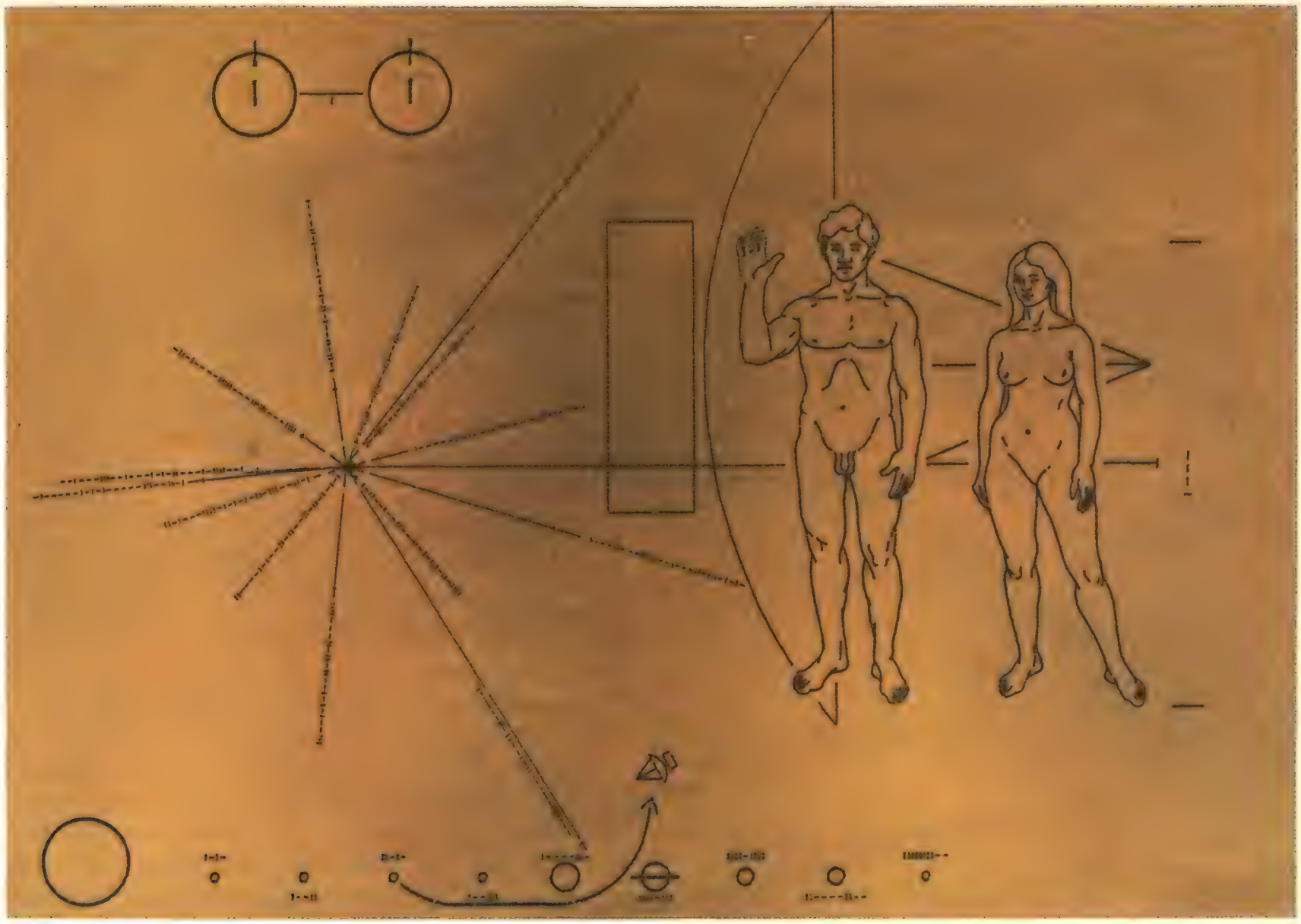
of planetary systems and the likelihood of the origin of life within them, which we know less well; and the probability of the evolution of intelligent life and the lifetime of technical civilizations, about which we know very little indeed. When we do the arithmetic, the number that my colleagues and I come up with is around a million technical civilizations in our Galaxy alone. That is a breathtakingly large number, and it is exhilarating to imagine the diversity, lifestyles and commerce of those million worlds. But there may be as many as 250 billion stars in the Milky Way galaxy. Even with a million civilizations, less than one star in 250,000 would have a planet inhabited by an advanced civilization. Since we have little idea which stars are likely candidates, we will have to examine a huge number of them. Thus the quest for extraterrestrial intelligence may require a significant effort.

Despite claims about ancient astronauts and unidentified flying objects, there is no firm evidence of past visitations to the Earth by other civilizations, and so we are restricted to looking for signals from afar. Of the long-distance techniques available to our technology, radio is by far the best. Radio telescopes are relatively inexpensive; radio signals travel at the speed of light, faster than which nothing can travel; and the use of radio for communication is not an anthropocentric activity: radio represents a large part of the electromagnetic spectrum, and any technical civilization anywhere in the Galaxy will have discovered radio, just as we have. Advanced civilizations might very well use some other means of communication with their peers—"zeta rays," say, which we might not discover for centuries. But if they wish to communicate with less advanced civilizations, there are only a few obvious methods, the chief of which is radio.

The first serious attempt to listen to possible radio signals from other civilizations was set up at the National Radio Astronomy Observatory in Greenbank, West Virginia, in 1959. This program, organized by Frank Drake who is now at Cornell University, was called Project Ozma, after the princess of L. Frank Baum's *Land of Oz,* a place exotic, distant and difficult to reach. Drake examined two nearby stars, Epsilon Eridani and Tau Ceti, for a few weeks with negative results. Positive results would have been astonishing, because, as we have seen, even rather optimistic estimates of the number of technical civilizations in the Galaxy imply that several hundred thousand stars must be examined in order to achieve success by random stellar selection.

Since Project Ozma, there have been six or eight other such programs, all at a rather modest level, in the United States, Canada and the Soviet Union. Not one of them has achieved positive results. The total number of individual stars examined to date is fewer than 1,000. We have performed something like one-tenth of one percent of the required effort.

However, there are signs that much more serious



Metal greeting cards on Pioneers 10 and 11 locate sun with respect to 14 pulsars (burst pattern). Craft is shown leaving Earth and swinging by Jupiter before heading into deep space (bottom). Straight line behind pair of humans, whose dimensions are given in units of the radio emission of hydrogen, indicates distance to center of Galaxy. Pioneer may continue journey after mankind has perished.

efforts may be mounted in the reasonably near future. All the observing programs to date have involved either tiny amounts of time on large radio telescopes or large amounts of time on smaller telescopes. In a major scientific study for the National Aeronautics and Space Administration, directed by Philip Morrison of the Massachusetts Institute of Technology, the feasibility and desirability of more systematic investigations have been powerfully underscored. The study has four main conclusions: "(1) It is both timely and feasible to begin a serious search for extraterrestrial intelligence; (2) a significant . . . program with substantial potential secondary benefits can be undertaken with only modest resources; (3) large systems with great capability can be built as needed; and (4) [such a search] is intrinsically an international endeavor in which the United States can take a lead." The study carries a reassuring foreword by the Reverend Theodore Hesburgh of Notre Dame that such a search is consistent with religious and spiritual values, and includes the following ringing sentiment: "The question deserves . . . the serious and prolonged attention of many professionals from a wide range of disciplines—anthropologists, artists, lawyers, politicians, philosophers, theologians—even more than that, the concern of all thoughtful persons, whether specialists or not. We must, all of us, consider the outcome of the search. That search, we believe, is feasible; its outcome is truly important either way. Dare we begin? For us who write here that question has step by step become instead: *Dare we delay?*"

A wide range of options is identified in the Morrison report, including new (and expensive) giant ground-based and space-borne radio telescopes. But the study also points out that major progress can be made at modest cost by the development of more sen-

Titan, upper right, Saturn's largest moon, may have environment to support simple forms of life.

sitive radio receivers and of ingenious computerized data-processing systems.

In the Soviet Union there is a state commission devoted to organizing a search for extraterrestrial intelligence, and the large RATAN-600 radio telescope in the Caucasus, just completed, is to be devoted part-time to this effort. And along with spectacular advances in radio technology, there has been a dramatic increase in the scientific and public respectability of theories about extraterrestrial life. Indeed, the Viking missions to Mars (pp. 38-39) were, to a significant extent, dedicated to the search for life on another planet.

Of course, not all scientists accept the notion that other advanced civilizations exist. A few who have speculated on this subject lately are asking: if extraterrestrial intelligence is abundant, why have we not already seen its manifestations? Think of the advances by our own technical civilization in the last 10,000 years, and imagine such advances continued over millions or billions of years. If any civilizations are that much more advanced than we, why have they not produced artifacts, devices and even cases of industrial pollution of such magnitude that we would have detected them? Why have these beings not restructured the entire Galaxy for their convenience?

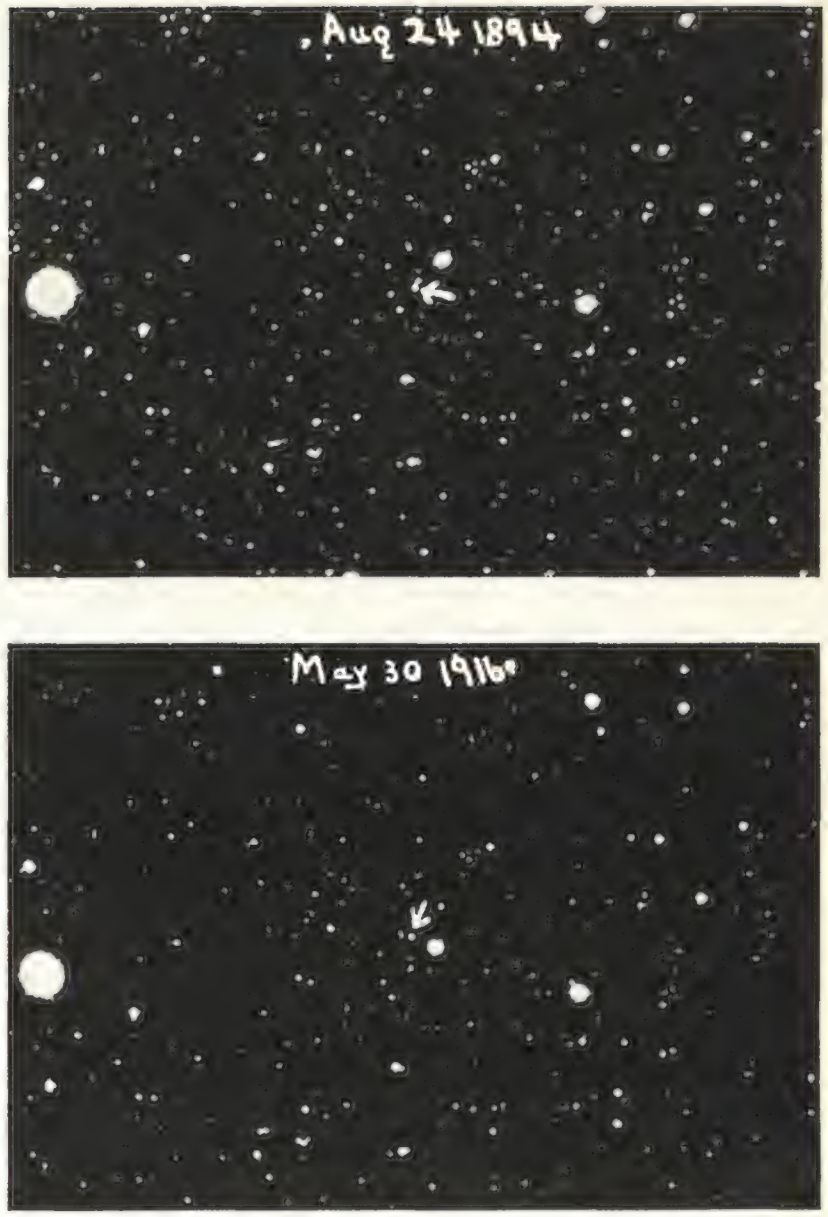
And why has there been no clear evidence of extraterrestrial visits to the Earth? We have already launched slow and modest interstellar spacecraft called Pioneers 10 and 11 and Voyagers 1 and 2—which, incidentally, carry small golden greeting cards from the Earth (p. 41) to any space-faring interstellar civilizations which might intercept them. A society more advanced than we should be able to ply the spaces between the stars conveniently, if not effortlessly. Over millions of years such societies should have established colonies which themselves might launch interstellar expeditions. Why are they not here? The temptation is to deduce that there are at most only a few advanced extraterrestrial civilizations—either because we are one of the first technical civilizations to have emerged, or because it is the fate of all such civilizations to destroy themselves before they are much further along.

It seems to me that such despair is quite premature. All such arguments depend on our correctly surmising the intentions of beings far more advanced than ourselves, and when examined closely I think these arguments reveal a range of interesting human conceits. For example, why do we expect that it will be easy to recognize the manifestations of very advanced civilizations? Is our situation not closer to that of isolated societies in the Amazon basin, say, who lack the tools to detect the powerful international radio and television traffic which is all around them? Also, there is a wide range of incompletely understood phenomena in astronomy. Might the modulation of pulsars or the energy source of quasars have a technological origin? Or perhaps there is a galactic ethic of noninterference with backward or emerging civilizations.

Perhaps there is a waiting time before contact is considered appropriate, so as to give us a fair opportunity to destroy ourselves first, if we are so inclined. Perhaps all societies significantly more advanced than our own have achieved an effective personal immortality, and lose the motivation for interstellar gallivanting—which may, for all we know, be a typical urge only of adolescent civilizations. Perhaps mature civi-

lizations do not wish to pollute the cosmos. There is a very long list of such "perhapses," few of which we are in a position to evaluate with any degree of assurance.

The question of extraterrestrial civilizations seems to me entirely open. Personally, I think it far more difficult to understand a universe in which we are the only technological civilization, or one of but a few, than to imagine a cosmos brimming over with intelligent life. Many aspects of the problem, fortunately, can be experimentally verified. We can search for planets of other stars; seek simple forms of life on such nearby worlds as Mars, Jupiter and Saturn's moon Titan; and perform more extensive laboratory studies on the chemistry of the origin of life. We can investigate more deeply the evolution of organisms and societies. The problem cries out for a long-term, open-minded and systematic search, with nature as the only arbiter of what is or is not likely.



Barnard's Star first aroused astronomers' curiosity because of its rapid motion (arrows above). Unusual signals it emitted have intrigued some SETI investigators.

A simple code for complex messages

If there are a million technical civilizations in the Milky Way galaxy, the average separation between civilizations will be about 300 light years. Since a light year is the distance which light travels in one year (a little under six trillion miles), this implies that the one-way transit time for an interstellar communication from the nearest civilization will be some 300 years. The time for a query and a response would be 600 years. This is the reason that interstellar dialogues are much less likely—particularly around the time of first contact—than interstellar monologues. It might seem remarkably selfless for a civilization to broadcast radio messages with no hope of knowing, at least in the immediate future, whether they have been received and what the response to them might be.

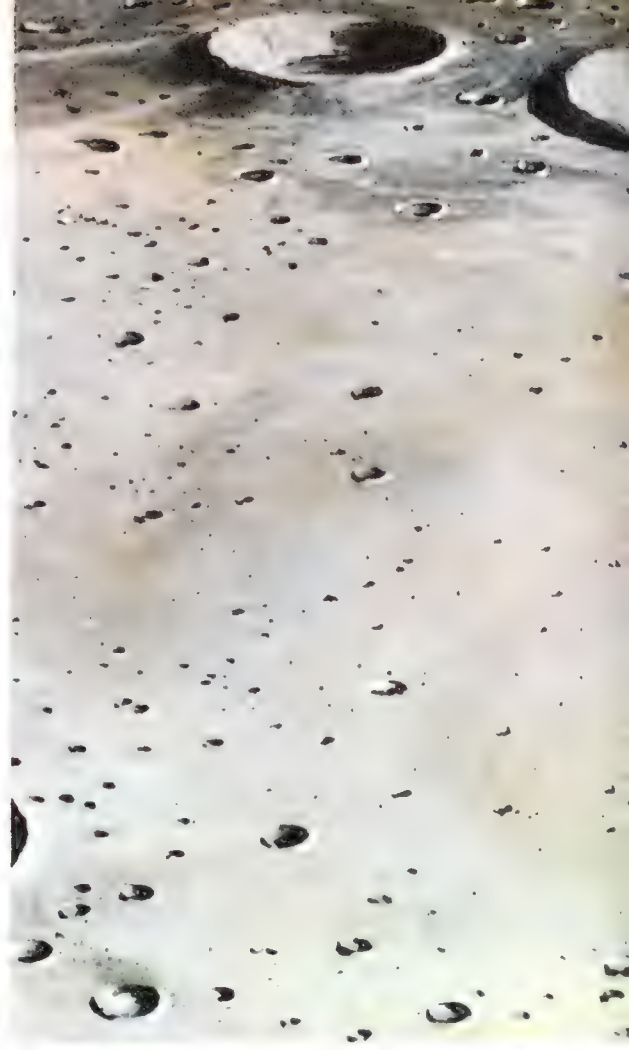
But human beings often perform very similar actions—as, for example, in burying time capsules to be recovered by future generations, or even in writing books, composing music and creating art intended for posterity. A civilization which had been aided by the receipt of such a message in its past might wish to similarly benefit other emerging technical societies. The amount of power that need be expended in interstellar radio communication should be a tiny fraction of what is available for a civilization only slightly more advanced than we, and such radio transmission services could be an activity either of an entire planetary government or of relatively small groups of hobbyists, amateur radio operators and the like.

Although probably no previous contact will have been achieved between transmitting and receiving civilizations, communication in the absence of prior contact is possible.

It is easy to create an interstellar radio message which can be recognized as emanating unambiguously from intelligent beings. A modulated signal ("beep," "beep-beep," . . .) comprising the numbers 1, 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, for example, consists exclusively of the first 12 prime numbers—that is, numbers that can be divided only by 1, or by themselves. A signal of this kind, based on a simple mathematical concept, could only have a biological origin. No prior agreement between the transmitting and receiving civilizations, and no precautions against Earth chauvinism, are required to make this clear.

Such a message would be an announcement or beacon signal, indicating the presence of an advanced civilization but communicating very little about its nature. The beacon signal might also note a particular frequency where the main message is to be found, or might indicate that the principal message can be found at higher time resolution at the frequency of the beacon signal. The communication of quite com-

"Cyclops," a hypothetical array of 1,500 antennas, could detect radio traffic anywhere in Galaxy.



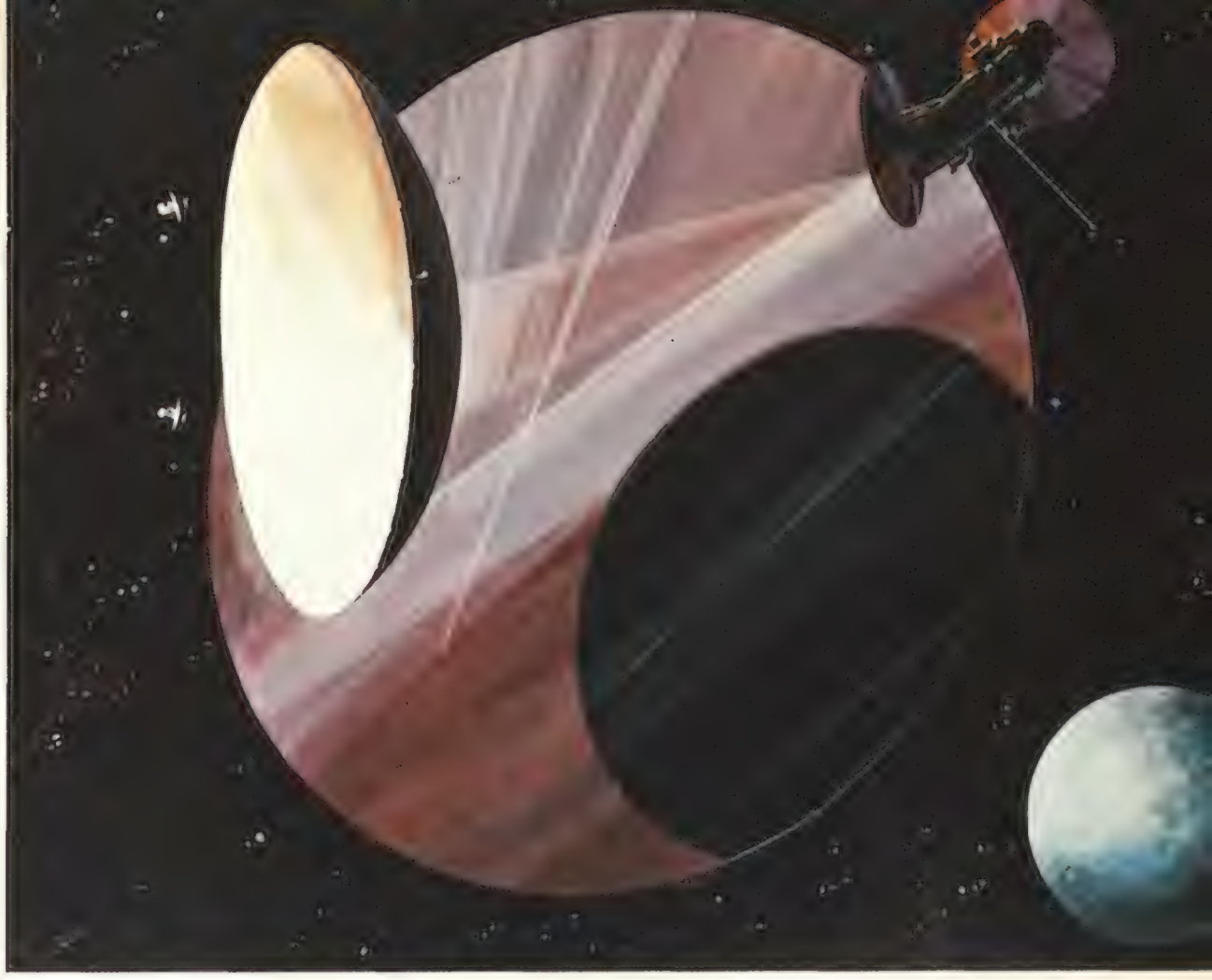
Twenty 200-meter antennas in lunar "Cyclops" could

plex information is not very difficult, even for civilizations with extremely different biologies and social conventions. For example, arithmetical statements can be transmitted, some true and some false, and in such a way it becomes possible to transmit the ideas of true and false—concepts which might otherwise seem extremely difficult to communicate.

But by far the most promising method is to send pictures. The message might consist of an array of zeros and ones transmitted as long and short beeps, or tones on two adjacent frequencies, or tones at different amplitudes, or even signals with different radio polarizations. Properly arranged in rows and columns, the zeros and ones form a visual pattern—a picture similar to those an imaginative typist can create by using the letters of the alphabet as a medium. Just such a message was transmitted to space by the Arecibo Observatory, which Cornell University runs for the National Science Foundation, in November 1974 at a ceremony marking the resurfacing of the Arecibo dish—the largest radio/radar telescope on Earth (SMITHSONIAN, July 1974). The signal was sent to a collection of stars called M13, a globular cluster comprising about a million separate suns, because it was overhead at the time of the ceremony. Since M13 is 24,000 light years away, the message will take 24,000 years to arrive there. If anyone is listening, it will be 48,000 years before we receive a reply. The Arecibo message was clearly not intended as a serious attempt at interstellar communication, but rather as an indication of the remarkable advances in terrestrial radio technology.

The decoded message (p. 47) forms a kind of pictogram that says something like this: "Here is how we count from one to ten. Here are five atoms that we think are interesting or important: hydrogen, carbon, nitrogen, oxygen and phosphorus. Here are some ways to put these atoms together that we think interesting or important—the molecules thymine, adenine, guanine and cytosine, and a chain composed of alternating sugars and phosphates. These molecular building blocks are put together to form a long molecule of DNA comprising about four billion links in the chain. The molecule is a double helix. In some way this molecule is important for the clumsy looking creature at the center of the message. That creature is 14 radio wavelengths or 5 feet 9.5 inches tall. There are about four billion of these creatures on the third planet from our star. There are nine planets altogether, four big ones toward the outside and one little one at the extremity. This message is brought to you courtesy of a radio telescope 2,430 wavelengths or 1,004 feet in diameter. Yours truly." Especially with many similar pictorial messages, each consistent with and corroborating the others, it is very likely that almost unambiguous interstellar radio communication could be achieved even between two civilizations which have never met. Of course our immediate objective is not to send such messages, because we are very young and backward; we wish to listen.

operate free of any radio
interference from home planet.



Artist's concept of a three-kilometer spheroidal
SETI complex hovering in orbit some 23,000 miles up.

The detection of radio signals from space would illuminate many questions which have concerned scientists and philosophers since prehistoric times. Such a signal would indicate that the origin of life is not an extraordinarily unlikely event. It would imply that given billions of years for natural selection to operate, simple forms of life generally evolve into complex and intelligent forms, as on Earth, and that such intelligent forms commonly produce an advanced technology. But it is not likely that the transmissions we receive will be from a society at our own level of technological advance. A society only a little more backward than we will not have radio astronomy at all. The most likely case is that the message will be from a civilization with a far superior technology. Thus, even before we decode such a message, we will have gained an invaluable piece of knowledge: that it is possible to avoid the dangers of the period of technological adolescence we are now passing through.

There are some who look on our global problems here on Earth—at our vast national antagonisms, our nuclear arsenals, our growing populations, the disparity between the poor and the affluent, shortages of food and resources, and our inadvertent alterations of the natural environment of our planet—and conclude that we live in a system which has suddenly become unstable, a system which is destined soon to collapse. There are others who believe that our problems are soluble, that humanity is still in its childhood, that one day soon we will grow up. The existence of a single message from space will show that it is possible to live through technological adolescence: the civilization transmitting the message, after all, has survived. Such knowledge, it seems to me, might be worth a great price.

Another likely consequence of the receipt of an interstellar message is a strengthening of the bonds which join all human and other beings on our planet. The sure lesson of evolution is that organisms elsewhere must have had separate evolutionary pathways; that their chemistry and biology, and very likely their social organizations, will be profoundly dissimilar to anything which is familiar here on Earth. We may well be able to communicate with them because we share a common universe; because the laws of physics and chemistry and the regularities of astronomy are shared by them and by us. But they may always be, in the deepest sense, different. And when we recognize these differences, the animosities which divide the peoples of the Earth may wither. The differences among human beings of separate races and nationalities, religions and sexes are likely to be insignificant compared to the differences between all humans and all extraterrestrial intelligent beings.

If the message comes by radio, both transmitting and receiving civilizations will have in common at least the details of radiophysics. The commonality of the physical sciences is the reason that many scientists expect the messages from extraterrestrial civilizations to be decodable. No one is wise enough to predict in

Is anyone out there?

detail what the consequences of such a decoding will be, because no one is wise enough to understand beforehand what the nature of the message will be. Since the transmission is likely to be from a civilization far in advance of our own, stunning insights are possible in the physical, biological and social sciences, insights reached from the perspective of a quite different kind of intelligence.

Decoding such a message will probably be a task of years and decades, and the decoding process can be as slow and careful as we choose. Some have worried that such a message from an advanced society might make us lose faith in our own, might deprive us of the initiative to make new discoveries if it seems that there are others who have made those discoveries already, or might have other negative consequences. But I stress that we are free to ignore an interstellar message if we find it offensive. Few of us have rejected schools because teachers and textbooks exhibit learning of which we were so far ignorant. If we receive a message, we are under no obligation to reply. If we do not choose to respond, there is no way for the transmitting civilization to determine that its message was received and understood on the tiny distant planet Earth. The receipt and translation of a radio message from the depths of space seems to pose few dangers to mankind; instead, it holds the greatest promise of both practical and philosophical benefits for all of humanity.

It is possible that an early message may contain detailed prescriptions for the avoidance of technological disaster, for a passage through adolescence to maturity. Perhaps the transmissions from advanced civilizations will describe which pathways of cultural evolution are likely to lead to the stability and longevity of an intelligent species, and which other paths lead to stagnation or degeneration or disaster. Perhaps there are straightforward solutions, still undiscovered on Earth, to problems of food shortages, population growth, energy supplies, dwindling resources, pollution and war. There is, of course, no guarantee that such would be the contents of an interstellar message; but it would be foolhardy to overlook the possibility.

There will surely be differences among civilizations which cannot be glimpsed until information is available about the evolution of many civilizations. Because of our isolation from the rest of the cosmos, we have information on the evolution of only one civilization—our own. And the most important aspect of that information, the future, remains closed to us. Perhaps it is not likely, but it is certainly possible that the future of human civilization depends on the receipt and decoding of interstellar messages.

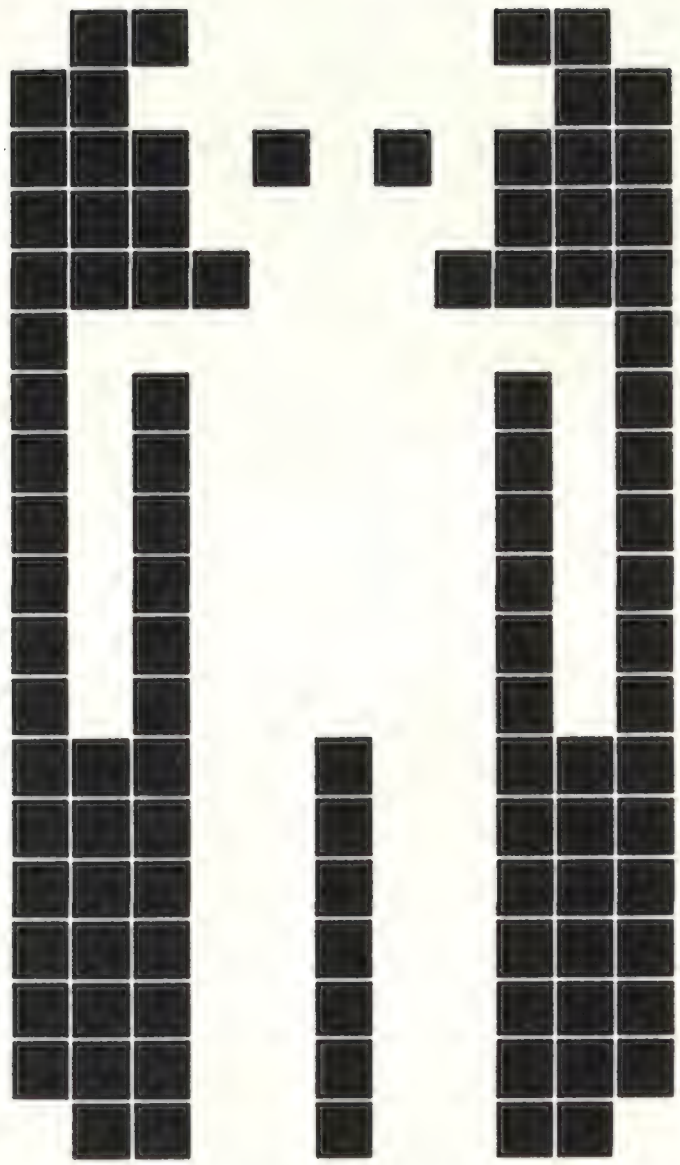
And what if we make a long-term and dedicated search for extraterrestrial intelligence and fail? Even then we surely will not have wasted our time. We will have developed an important technology, with applications to many other aspects of our own civilization. We will have greatly added to our knowledge of the physical universe. And we will have calibrated the importance and uniqueness of our species, our civilization and our planet. For if intelligent life is rare or absent elsewhere, we will have learned something about the rarity and value of our culture and our biological patrimony, which have been painstakingly extracted over four billion years of tortuous evolutionary history.

What it means if no one is there

Such a finding will stress as perhaps nothing else can our responsibilities to future generations: because the most likely explanation of negative results, after a comprehensive and resourceful search, is that societies destroy themselves before they are advanced enough to establish a high-power radio transmitting service. Thus, organization of a search for interstellar radio messages, quite apart from the outcome, is likely to have a cohesive and constructive influence on the whole of the human condition.

But we will not know the outcome of such a search, much less the contents of messages from interstellar civilizations, if we do not make a serious effort to listen for signals. It may be that civilizations are divided into two great classes, those which make such an effort, achieve contact and become new members of a loosely tied federation of galactic communities, and those which cannot or choose not to make such an effort, or who lack the imagination to try, and who in consequence soon decay and vanish.

It is difficult to think of another enterprise within our capability and at relatively modest cost which holds as much promise for the future of humanity.



For a complete message, here is a SETIgram

Binary numerals (ones and zeros) broadcast as dots and dashes can be used to transmit complex information. In the model above, when the recipient arranges the message units in logical order and translates them into black and white squares, a human outline appears. More complex message at right was actually sent to star cluster M13 in 1974. Decoded, from top: binary numbers 1-10, atomic numbers of life elements (red), formulas for DNA nucleotide sugars and bases (green), DNA double helix (blue), number of nucleotides in DNA (white), human figure (red), height of man (blue), solar system (yellow), and shape (purple) and diameter (white) of telescope which transmitted the message.

Pure science abhors a fantasy-filled vacuum

Philosophers and scientists have long wondered if life forms capable of reason might have evolved on other worlds. So, for that matter, have writers, film makers and other artists, who in their work have populated the distant reaches of space with everything from bug-eyed monsters to lovable robots, a divertissement which most pure scientists dislike. On these pages, the fertile imagination of illustrator John Huehnergarth anticipates what we *might* find *out there.*

Ah, the problems and the payoffs that await us as we venture into the Huehnergarthian void—the shock of the first contact, the delight of new knowledge, the fear of cosmic aggression, the jolt to our egos, the invasion of our privacy, the joys of gossip on a galactic party line. Whether The Force will be with them or with us it is impossible to tell. But no life—theirs or ours—will ever be the same.

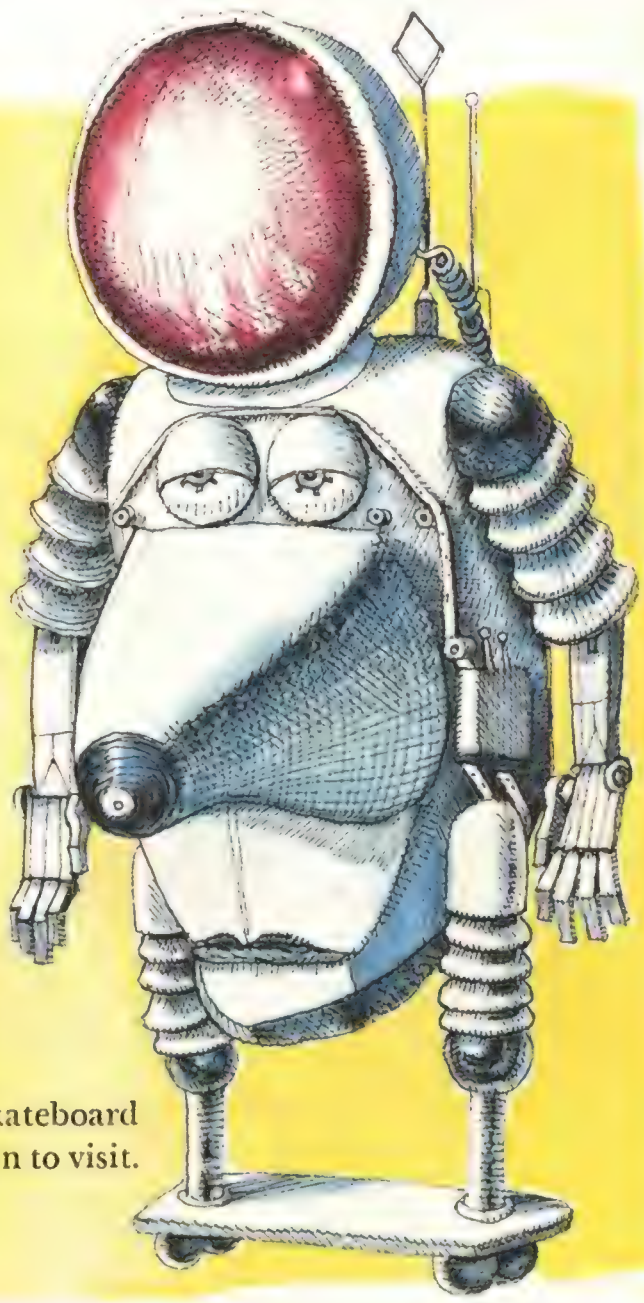
Once the shock wears off, we might make some great advances—with a little help from our friends.

Alien probe, attracted by friendly greeting from Earth, zooms down for a closer inspection.

Man's early TV signals have traveled far into space. Whatever will they make of Milton Berle?

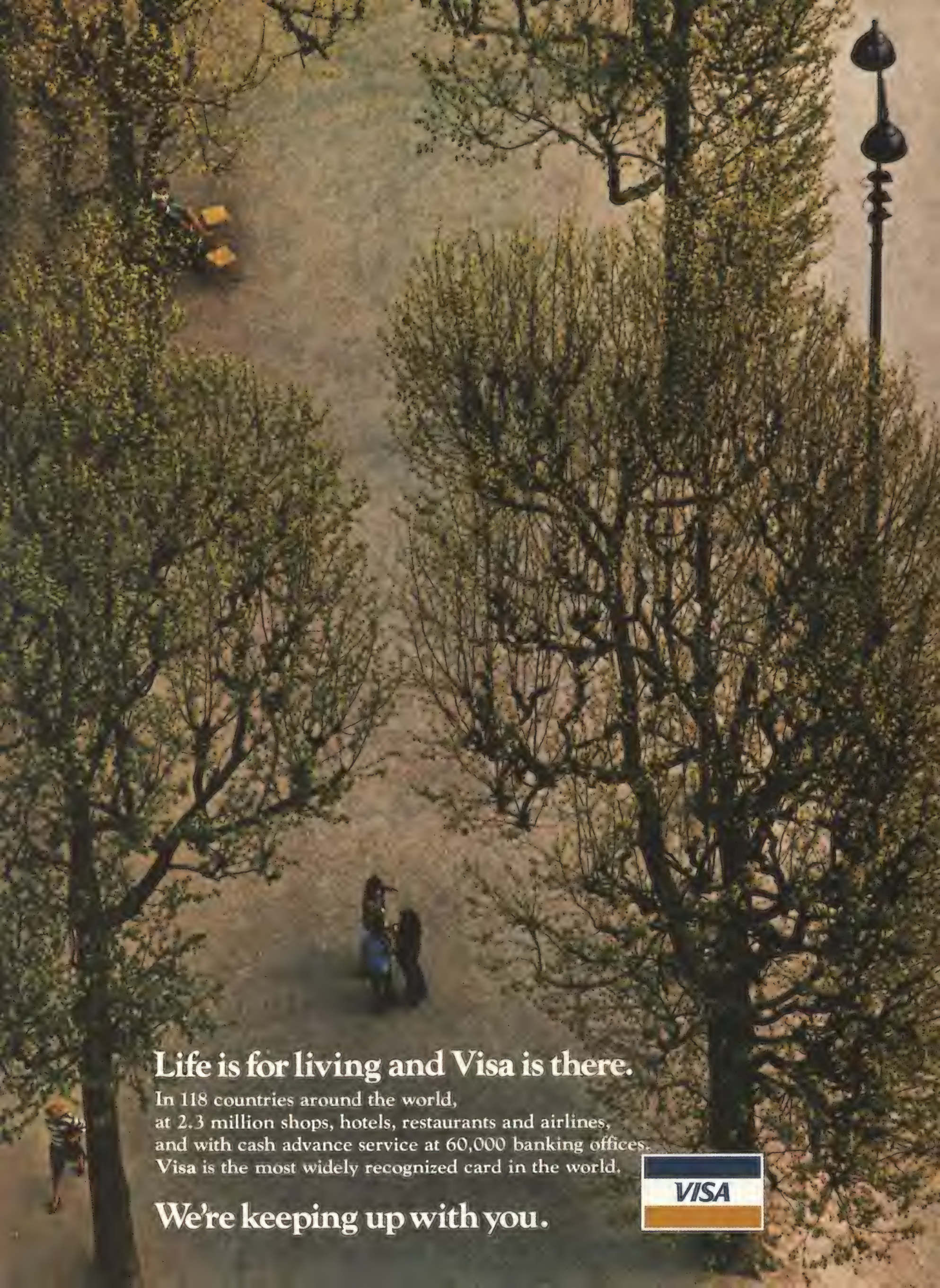
Whoever they are, they won't look much like us—yet as thinking beings they *may* seem vaguely familiar.

Cosmic radio astronomers need big ears and patience. Instant contact with outsiders would be surprising.



Bionic freak with skateboard could roll down to visit.

Looking toward the sky, listening for the signal, we wonder whether there are around us others who dream, suffer and speculate as we do. The big answer may be on its way—now—at the speed of light.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By Elizabeth P. Benson

100th century B.C. MEXICO 20th century A.D.

Rich collections of art open at two Smithsonian museums

Expressiveness and formal power of post-Classic art, A.D. 900-1200, is evident in this skillfully modeled figure, 35-7/16 inches high. Possibly a goddess, because of size and quality. Veracruz.

Disciplined use of space and emotional power typical of so much Mexican art over the centuries is powerfully employed in David Alfaro Siqueiros' *Nuestra Imagen Actual* (*Our Image Today*) 1947.

Twelve millennia of Mexican art

From beneath the plaza which supports Mexico City's great cathedral, buried since Aztec times, the moon goddess (opposite page) rediscovered.

The recent discovery of a major Aztec sculpture near the great cathedral of Mexico City has intensified the already rising interest in an encompassing exhibition of art from Mexican public museums now being shown in the United States.

The cathedral is built over the ruins of the ceremonial center of Tenochtitlán, the capital of the Aztecs—or Mexicas, as they are now usually called in Mexico—where a good deal of sculpture has already been found. This latest discovery (below and opposite page) is a representation of Coyolxauhqui, the moon goddess, who was beheaded by her brother, Huitzilopochtli, the Aztec tribal god who was also god of the sun. (This myth, of course, is recaptured in nature every day.) Carved in relief on a full-moon-shaped stone, three meters in diameter, the body of the goddess is seen with amputated arms and legs neatly fitted into the circle (opposite); the decapitated head is carved with disks on the cheeks, for the name of the goddess is "she who is adorned with bells."

The exhibition, one of only three such shows ever to come to the United States—and this article—present broad views of Mexican art from the time, 12,000 years ago, when a craftsman in the highlands carved an animal bone, through the "three greats" of the 20th century—Rivera, Orozco and Siqueiros. Brought to the United States by the Armand Hammer Foundation, with the cooperation of the Mexican government and participating U.S. museums, the exhibition, in two parts, is currently on display at the Smithsonian's National Museum of Natural History and diagonally across the Mall at the Hirshhorn Museum and Sculpture Garden. It will be shown later at the Knoedler and Hammer Galleries in New York (June 6-July 23) and at the Los Angeles County Museum of Art (August 8-September 24).

Mexican art reached its first high point around 1200 B.C., when people, long settled in villages, had developed rich myths and intricate beliefs and had begun to build ceremonial centers. A civilization we now call "Olmec"—we have no idea what they called themselves in that dim, undocumented past—built mounds and plazas in the rain forest on the Gulf Coast of Mexico. There they raised impressive monuments of stone, one of which, a colossal head 5.8 feet tall and weighing about six tons, has been brought to the United States for the exhibition (cover). These heads never had bodies to go with them. Pre-Columbian peoples—natives of the New World before the coming of Columbus—evidently considered the head the most significant part of the body, and it is often represented

Elizabeth P. Benson, author of The Maya World, *is director of the Center for Pre-Columbian Studies at Dumbarton Oaks in Washington, D.C.*

Brought to light with only one bite missing—out of upper right quadrant—the intricately carved relief shows moon goddess, grotesquely dismembered but neatly fitted into coherent artistic design. The superb sculpture depicts the goddess who, in myth, was cut up by the god of the sun.

in considerable detail and disproportionately large. Because the head was the most effective place to rob one's enemy of power, and because it made an appropriate offering to a god, ritual decapitation was a common practice.

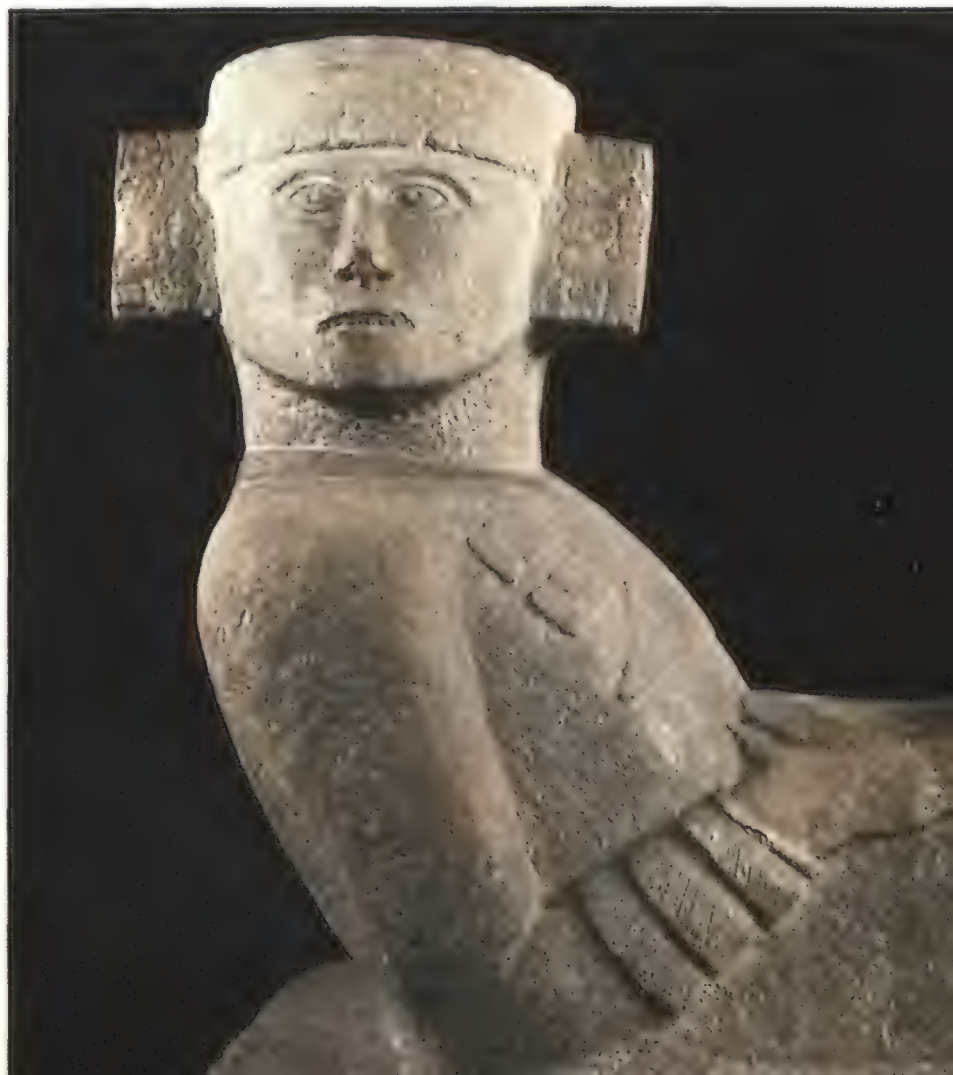
Another, smaller Olmec monument in the exhibition was found in 1965, and was carried by Indians to the village of Las Limas, where some took it for the apparition of a saint. An altar was set up for it; it was dressed with a cape and a wreath of flowers, and worshiped. Although it looks like a Madonna, the figure is probably male; it depicts a recurrent theme in Olmec art, that of a human being, perhaps an Olmec king, who holds a "baby" that has the combined features of a human infant and a jaguar. Jaguars, the largest cats in the New World, are frequently represented in pre-Columbian art.

The Valley of Mexico, where Mexico City is located, shared in this early cultural florescence. Clay figurines and pots, often influenced by the Olmec art style, were made in great quantity. The figurines—seated children, acrobats and "pretty ladies," as archaeologists call them—are charming and whimsical to us, but they clearly had magical or religious significance to the people who made them.

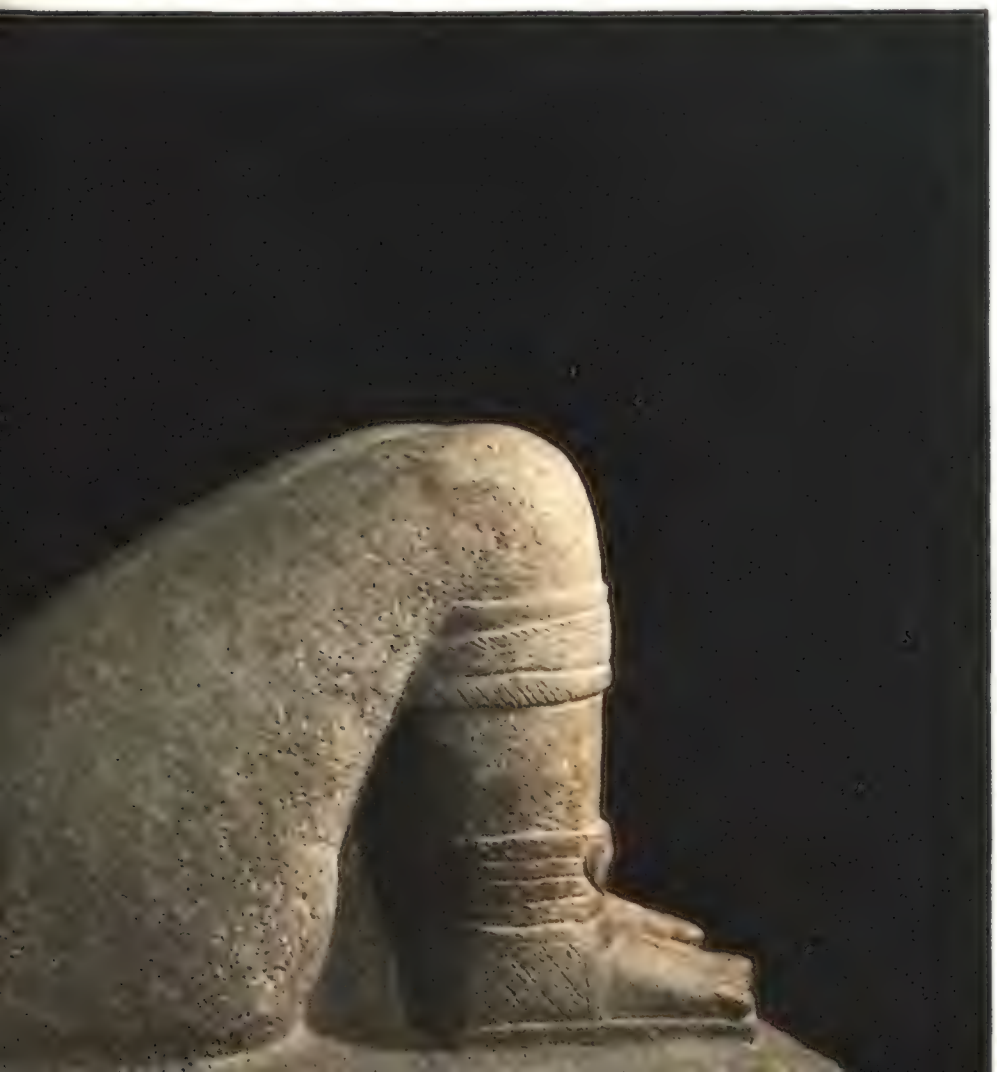
In the first centuries of the Christian era, the city of Teotihuacán had begun to develop at the northeastern edge of the Valley of Mexico. Now a famous tourist attraction, its great pyramids, known to Mexicans as "*the* pyramids," reflect the shapes of the surrounding mountains. A ceremonial center and urban complex, its buildings were decorated with sculpture and mural paintings that expressed religious beliefs about things important in the pre-Columbian universe.

Between A.D. 300-900, all over Mexico, civilizations that we call Classic were flourishing. That of the Maya is probably the best known and most admired. The

Imaginative rendition of a Chihuahua (above) combining the useful and the artful, and less than six inches high, is from Colima. Classic period, A.D. 200-650. Below, with a tray of offerings in his



hands, is nonchalant figure called a Chac-Mool. Large sculptures such as this were placed in front of temples, much like architectural sculpture today. Mayan, Early post-Classic, A.D. 900-1250.



Maya were not only great artists, architects and city planners, but also astronomers, mathematicians and the only people in the New World to have a true form of writing. Their monuments have long texts which record important data about Maya god-kings: ancestors, birth, death, the rituals they underwent, their claims to power in this world and the other. The stone lintel from Yaxchilán in the exhibition commemorates the ruler of that site, who is called "Shield-Jaguar" because his name glyph shows a jaguar head with a shield affixed to it.

A ritual ball game

Central Veracruz, on the Gulf Coast, is a region where rubber is indigenous. Here, from early times, people made balls of rubber and played a ritual game. Virtually every ceremonial center in Mexico has at least one ball court in the heart of the site; the major Classic site in Veracruz, El Tajín, has at least seven. The two most important sculpture forms here at this time—stone "yokes" and "axes"—are associated with the ball game.

The site of Monte Alban, in the mountains of Oaxaca, was prominent in the Olmec and post-Olmec periods—calendrics and proto-hieroglyphic notations may have begun there—and it was also an important Classic center, particularly noted for its clay urns depicting the deities of natural forces.

By A.D. 900, all the Classic cultures had vanished and different styles of art appeared. Teotihuacán was largely destroyed, perhaps by barbarian invaders from the north, around A.D. 700. In Yucatán, a reclining figure, called a Chac-Mool (pp. 56-57), from Chichén-Itzá, is a close relative of similar rain-god-related figures found in central Mexico. In the main Maya area there was a mysterious population decrease, although the remains of Maya sites are still there, for the most part damaged only by time, weather and grave robbers—and Maya-speaking people still exist in large numbers.

Throughout the history of pre-Columbian Mexico there were constant movements of people and shifts of power, expressed by changes in art styles. But nothing ever stopped completely. Xochicalco, a hillside city commanding a splendid view south of Mexico City, began in the Classic period and continued into the post-Classic, with debts in its art and architecture to Teotihuacán, Monte Alban, El Tajín and the Maya. A stela from Xochicalco, showing a face in open serpent jaws, probably represents Quetzalcóatl, "the feathered serpent." Quetzalcóatl was, variously, a god, a king, a priest, a title and a manifestation of the planet Venus.

Post-Classic Tula, the capital of the Toltecs, which

Marvelously fanciful feathered coyote bears at center of breast the name Ce Acatl, alluding to the god Quetzalcóatl. A.D. 1325-1521.

lies in the highlands north of Mexico City, was the home of a more-or-less historical Quetzalcóatl, the founder of this city, who took the title as a priest of the god. Quetzalcóatl is represented on a Toltec relief sculpture in the exhibition, again in the open jaws of a serpent; this is a form of representation shown also in late Maya and in Aztec sculpture.

The Aztecs were the most powerful people in Mexico at the time the Spanish conquerors came in the early 16th century. Because there was direct contact, they are, of all pre-Columbian Mexican peoples, those about whom most is known. The Aztecs had come from the less developed country to the north to establish their city of Tenochtitlán in the 14th century. They conquered other peoples around them, taking prisoners for sacrifice and adopting the gods of these other peoples and fitting them into the Aztec cosmos. Quetzalcóatl was one of the most important deities of the very complex Aztec pantheon. According to Aztec legend, the god had sprinkled his blood on the bones of men from the previous generations to form the inhabitants of this creation of the world. The idea that Man must nourish the gods with his blood because a god had performed blood sacrifice for him is a basic tenet of Aztec thought, and probably of earlier Mexican peoples. These sacrifices kept the sun going across the sky and sustained the Earth gods. Aztec deities were complicated manifestations of the powerful elements in the universe: the heavenly bodies, the Earth, water and rain, and seasonal renewal.

A statue of an Earth god, Tlaltecuhtli, found in Mexico City in 1967, is an example of an Aztec deity shown as a collection of unpleasant traits: there are claws at the elbows and knees, a full-face death's-head at the back, and skulls and crossbones at the sides. Death imagery, so common in Aztec and earlier art, is intimately associated with rebirth and renewal.

The great craftsmen in this late period worked in and around Monte Alban, the source of some of the finest painted manuscripts, lapidary work and cast-gold jewelry made by a technique introduced into Mexico about A.D. 1000. Not merely ornaments, these gold objects had religious significance; one of the ornaments in the exhibition represents the death god, and another the flayed god, who is shown wearing someone else's skin to symbolize spring and the regeneration of the Earth.

The exhibition emphasizes the continuity in Mexican art. From Olmec through Aztec times, there was constancy as well as change. Pottery figurines and vessels—all made in molds or with coils of clay, not on a potter's wheel—are found from all periods. Pottery was always significant, although the wares vary: the Maya made poor wares, but decorated them superbly; finer potteries were the Fine Orange of Teotihuacán,

the plumbate of the Toltecs, and the polychromes of post-Classic Oaxaca. The potters of the West Coast, in the states of Colima, Nayarit and Jalisco, produced figures of human beings, birds and dogs that have long charmed collectors. Although the West Coast people were not in the mainstream of development, they shared many basic ideas with the rest of Mexico.

Another region of some cultural isolation is Guerrero, a state lying between central Mexico and the West Coast that produced very distinctive small sculptures of figures, masks and miniature temples in the Mezcala style, but it did not produce monumental sculpture, architecture or murals, the enduring traits of most pre-Columbian Mexico.

The moment of greatest discontinuity in Mexican art came in the early 16th century, when the Spanish conquistadores came to conquer and disrupt, bringing a totally strange civilization and a new religion backed by the zeal of the Inquisition. The old art forms essentially disappeared with the old gods, and yet there is some continuity. The Spanish friars built on common elements in the two religions (the cross had symbolic content for the Indians, and at least one of the Aztec deities would hear confession); because the two religions were merged in this way to expedite conversion, Christianity has perhaps never been completely pure in Mexico.

At first, post-Conquest artists were Indians working under Spanish tutelage, sometimes painting frescoes in the rich churches that were being raised to supplant

A face panel representing the birth of Ce Actl Topiltzin, a priest of the powerful god Quetzalcóatl. Toltec, A.D. 900-1200.

A Mayan late Classic, A.D. 600-900, richly colored and worked bowl of the kind employed formalistically as ritual objects in temples.

Melodramatic in its intensity of expression, and highly decorative, this Mixtec breastplate of gold is 4½ inches high. A.D. 1300-1521.

the temples in which their ancestors had painted. Then, European painters brought the influences of Italy and the Netherlands, the art centers of the time, and, later, a strong influence from Spain. Oil painting, introduced along with the new styles and subject matter, became the dominant technique as the ancient art of mural painting was essentially lost.

As the colony prospered in post-Conquest peace, 17th-century painting flourished, but in the 18th century there was a decline, as the demand for paintings outran the number of good painters. In the first half of the 19th century, the war for independence and shifting political situations sapped creative forces. Juárez attempted reforms, but opposing forces invited the Archduke Maximilian of Austria to become emperor; after Maximilian's execution, Porfirio Díaz ruled for 30 years. It was not a time for Mexican artists to assert the national identity strongly. Although there was a close adherence to European styles, some works reveal at least an awareness of the Mexican past: two 19th-century paintings in the exhibition show the chieftains of Tlaxcala, an Aztec-period city in the Valley of Mexico, and another painting by José Maria Velasco—one of the distinguished academic painters of the late 19th century—depicts the ruins of Teotihuacán. Diego Rivera, at the age of ten, began as a pupil of Velasco at the Academy of San Carlos, the important traditional art school of Mexico.

The Mexican Revolution, which started in 1910, marked the turning point in Mexican art. Painters not only began to experiment with avant-garde ideas and the expression of Mexican political and social problems, but they also returned, not so much to the Indian past as to the Indian continuity.

The change began perhaps with Posada, a lithographer, whose fierce political caricatures included animated skeletons, dwarfs, monstrous animals and

The artist is unknown, and he was obviously a Sunday painter, but the occasion has been

creatures that were part human and part animal—all ingredients of pre-Columbian art. Rivera worked in his shop, and José Clemente Orozco was also influenced by him.

Another influential artist, born with the name of Murillo, chose to call himself Dr. Atl, a word from the Aztec language, Nahuatl. Moreover, he encouraged the notion that he inhabited a cave on the slopes of the famous, snow-covered volcano near Mexico City, Popocatépetl. The cave and volcano associations smack of pre-Columbian lore. He became an anarchist, rebelling against the Academy of San Carlos, and backed a number of the younger painters, including Diego Rivera.

documented: a *Banquet for General Antonio León in Oaxaca, 1844*. Nonacademic—in this case, amateurish—painting during 19th century recorded scenes from daily life with charming freshness.

With money from the sale of his paintings to Dr. Atl's friends, Rivera went to Spain to study and paint. Two of his paintings in the exhibition demonstrate the range of his interests. One is a Cubist picture, inspired by the experimentation in Europe; the other, executed in a broad, mural-like style, shows an Indian woman rolling out tortillas with a *mano* and a *metate*. The maize, the food, and the ancient implements—versions of which are found in many pre-Columbian sites—are still in use.

Rivera's broad interests are also reflected in his many activities. He was a spokesman who befriended young artists; he collected pre-Columbian art and Mexican folk art; he lived and studied in Europe; and he traveled widely in the United States, painting murals in San Francisco, Detroit and New York.

Orozco, the second of the "three greats," was largely self-taught (although he had begun preparation to be an architect before he became a painter). Because he did a number of harsh revolutionary caricatures, which the officials did not like, he went to California in 1917, and returned there in 1930 to paint murals at Pomona College. His murals at Dartmouth College illustrate a pictorial history of North America, including the pre-Columbian past in *The Advent of Quetzalcóatl*, which depicts the god looming over two massive pyramids. Some of his murals in Guadalajara also refer to Aztec days.

In the manner of Rivera's post-Parisian period, during which he rediscovered his roots in Mexican life and image, is this painting of 1924.

Rivera spent time painting and living in Paris during exciting days of World War I, when he painted the cubist *Portrait of a Poet*, 1916.

Although he was a part of the Revolution, painting what have been called "magnificently indignant frescoes," Orozco was also critical of it. His paintings are full of chains, skeletons and naked human bodies, but it has been said that he was more interested in the revolution of style than in political revolution.

When Orozco returned to Mexico in 1922, he joined a craft union that had been formed by the third of the well-known Mexican muralists, David Alfaro Siqueiros. Younger than the others, Siqueiros had first gone to jail at the age of 13 for his revolutionary activities. As a colonel in the Republican army, he went to Spain as a military attaché. There he saw Rivera, who introduced Siqueiros to Cubism, while Siqueiros informed Rivera of the revolutionary work at home. Siqueiros, too, went to California, where, in Los Angeles, he initiated a mural movement with a group of American pupils.

By 1919 the Revolution was essentially over, and about 1920 the mural-painting phase began. A number of buildings in Mexico were enriched with murals, and the United States also benefited from the art of these painters. Mexican artists painted walls as their ancestors had done before them at Teotihuacán, at the Maya and Toltec sites, and in the sacred caves of the Olmec. The art had all but died out, except for a tradition of painting murals in *pulquerías*, the little bars where the local fermented liquid of the maguey cactus was sold. The revival of this art was a sign of drastic change, esthetically and politically.

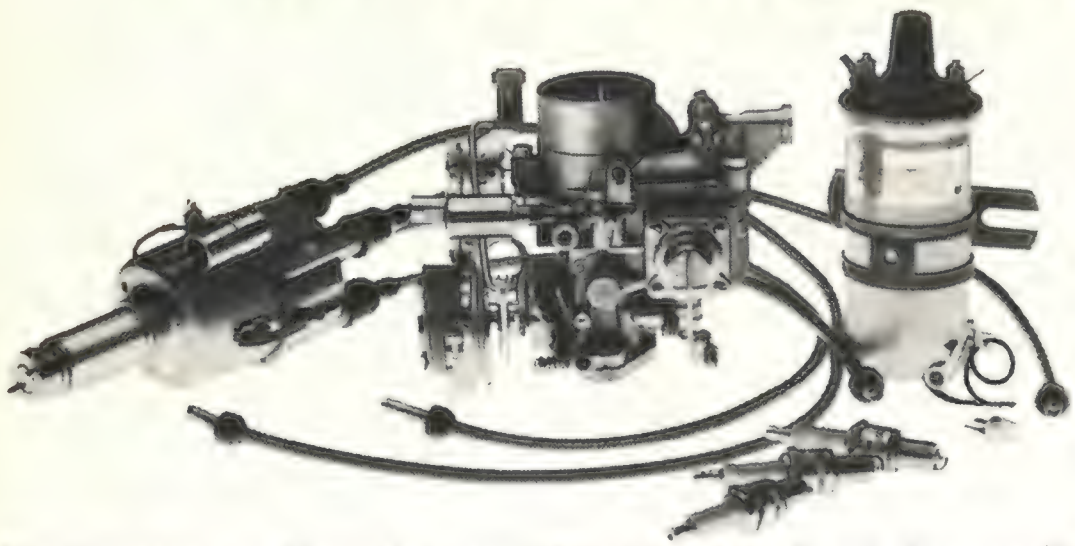
The craft union that Siqueiros had formed was aimed especially at the production of monumental murals. In the manifesto announcing the formation of this syndicate, easel painting was repudiated as being "ultra-intellectual" and "aristocratic." Monumental art was hailed because it was public property. All of the painters also produced small paintings, drawings and prints, some of which are shown in the exhibition; but most of these also have the quality of monumental art.

The exhibition is remarkable for its continuity over millennia and a common general theme—that of art which makes a statement about beliefs. Much of what we know about pre-Columbian civilizations comes from the representations in their art. Modern Mexico still depicts its world in its art, where alongside pictures of modern technology, modern social problems, and a long history of European influence, one still sees the enduring strength of the Indian world.

One of the grand modern masters of the art of social protest, José Clemente Orozco, 1883-1949, painted the expressionistic *The Tyrant* in 1947.

J.C. Orozco

What you should know about diesels. From the people who've been making them 50 years.



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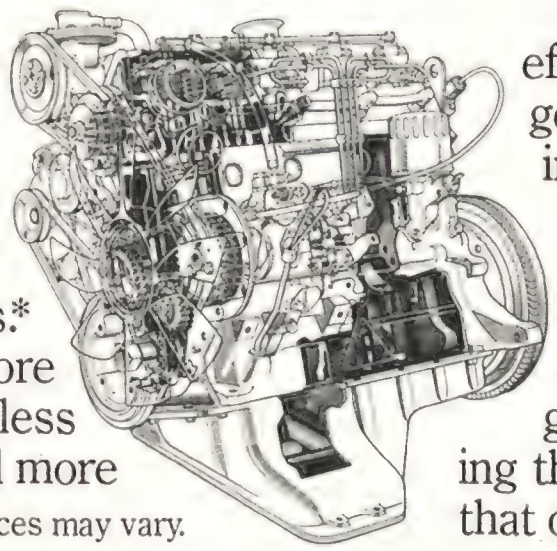
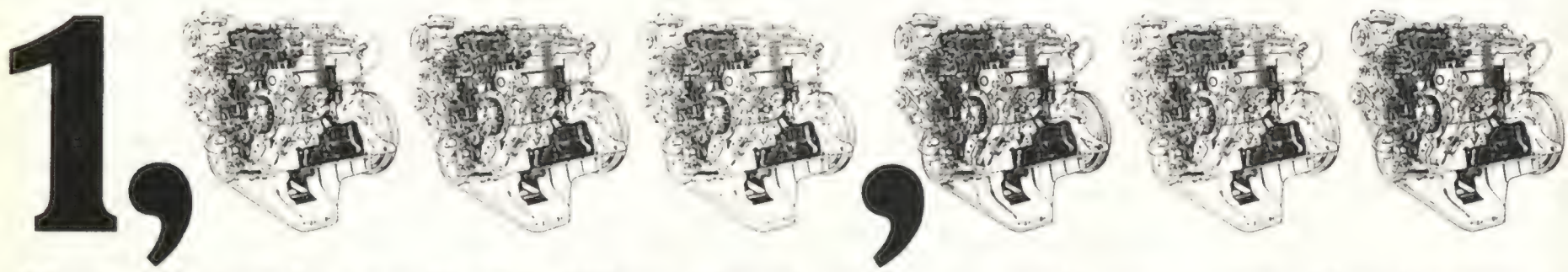


*Federal Energy Review Jan., 1978. Local prices may vary.



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Wild horses, as in French cave painting, may live in Europe again if Polish breeding experiment works.

By Rudolph Chelminski

Polish forest, a time machine

European bison thrive in historic forest while zoologists attempt to 'breed backward' to produce a tarpan, extinct race of horse

On the Soviet border in eastern Poland lies a forest where time has stopped: Bialowieza. The last vestige of the great forest that used to cover most of Europe, it is remarkable both in its own right and as the site of notable zoological experiments that have saved one animal from extinction and are close to re-creating—literally—another one.

After being only a few dozen beating hearts from extinction, the European bison again roams the parks, if not the countryside, of Europe. The forest tarpan, a race of wild horses that once inhabited much of Europe but disappeared a century ago, is even now reappearing through painstaking "back breeding" of hybrids that retain some of the original genetic material. The results (opposite) are getting close to the original model. And all this has happened in a few square miles of woodland that have survived all the wars and political upheavals of modern times.

The forest is about as far east as you can go in Po-

These horses, very much alive at Polish research center, closely resemble their prehistoric forebears.

The genetic material of the wild horse survived for centuries in hybrid stock owned by local farmers.

land without being arrested. The little village of Bialowieza, typically Central European rustic with its wooden farmhouses, duck ponds, chain-tethered milk cows and two-horsepower wagons, is only a few thousand yards from the present Soviet frontier, on the western edge of the famous Pripet Marshes and due north of the city of Brest Litovsk, which gained eminence in World War I for the treaty which Trotsky negotiated there, and for the heavy battles preceding it. So close is the frontier, in fact, that slightly more than half of the forest's acreage (but not the central game preserve) lies within the Soviet Union. The demarcation line is a neat strip of cleared but unmined land, patrolled on the Soviet side but left casually unsupervised by the Poles.

In the center of the forest, access to the game preserve is severely limited. Small groups of hikers are permitted to follow carefully designed pathways, but always in the company of a ranger. If anyone presumes to litter, stray off the path or—worse yet—raise his voice, he is instantly reprimanded. All traces of humankind, and most especially noise, are kept to a minimum. If a park official needs to carry anything into the preserve, he does so only with a rubber-tired horse cart; if a fallen tree needs to be trimmed or removed, it is cut up with a handsaw, then brought out by human and equine muscle power. Souvenir taking, even the least mushroom, is forbidden.

The illusion of a jump to another time, to another world, is stunning. If this is what Europe primeval looked like when Julius Caesar and his armored legions clanked into Gallia and Germania, it must have been an awesome place. Centuries of competition for sunlight have weeded out all but the most robust

No stranger to Eastern Europe and the Soviet Union, Mr. Chelminski writes frequently for SMITHSONIAN*—most recently in January—from his home base in Paris.*

Photographs by Ralph Crane

A forest almost primeval in Poland

trees; the survivors grow straight and theatrically tall. A few ancient oaks are said to be 500 years old and 125 to 130 feet high, but even they are dominated by the spruces, whose present champion measures 156 feet. Ground cover is lush—wild grasses, mosses, ferns, mushrooms and other short growth—but in contrast to the African or South American forests, which also produce canopies of tall trees, there is hardly any of the intermediate greenery which in the tropics can sometimes limit vision to a leafy wall. Instead, Bialowieza resembles an immense and uncannily well-tended park, where cathedral columns of tall trees soar upward from a fluffy green deep-pile carpet. Everything is silent, windless, shaded.

The creatures native to Bialowieza take care not to be seen; only the wild boars leave persistent marks on the ground, where they have snuffled and scratched away the surface in search of roots. Other animals that flourish there include roe deer, the European moose, otter, fox, beaver, lynx, weasel, badger, squirrel, muskrat and hare. Hunters long ago killed off the native bear, sable, wildcat and flying squirrel.

This natural marvel survived into the 20th century partly because of its relative inaccessibility, but even more so because of the pleasures of sport: ever since the late 1400s, Bialowieza had been reserved as a royal hunting grounds. Farming, land clearing and of course poaching were forbidden; would-be settlers were shooed away to less desirable areas. So pleasurable was the hunt that King Casimir Jagiello is said to have spent an uninterrupted seven-year stretch (1485 to 1492) inside the forest, treating the affairs of state from a forester's lodge. Hunting gave the forest its name: a royal chateau was built there and its most prominent features were high towers, presumably whitewashed. Bialowieza means "white tower."

What the Polish kings enjoyed hunting above all was *Bison bonasus*, the European bison (above). Taller than its American cousin (*Bison bison*), the European bison once roamed the continent from the Caspian to the Atlantic and as far north as Denmark.

Bialowieza was one of the last redoubts where the bison roamed wild. The Russian czars—who by the simple expedient of partitioning their neighbor inherited the royal reserve and its prerogatives—hunted bison there as late as the first decade of our present century. During the First World War the biggest battles were fought to the south, near Brest Litovsk, but German troops camped in the forest and began exploiting it. They removed millions of cubic meters of timber and slaughtered some 600 of the bison, leaving only a pathetic handful behind. The last wild survivor, a bull, was shot by a poacher in 1919. Luckily, there remained about three dozen half-domesticated ones in zoos.

Starting in 1929, Polish zoologists transported some of the half-tame stock to Bialowieza and began rebreeding. By 1939 the herd was up to 16—but then the Germans came again. They did not repeat their earlier slaughtering. Hermann Göring himself had hunted in the forest before the war (as a guest of the Polish government), and it was largely under his aegis that Bialowieza became a *German* game preserve and hunting grounds. Both the German attack on the Soviet Union and the Russian riposte rolled through Bialowieza, but damage to the forest was small. The herd came through the war numbering 17. There are

Healthy, if itchy, young European bison at Bialowieza attests to species' overcoming threat of extinction.

At a park in Polish forest preserve, an attendant offers willow branch to European bison or "wisent."

now about 220 in the park, with a surplus for export to foreign zoos and a few (unproductive old cows, unruly bulls) chosen as targets for modern hunters.

The story of the forest tarpan is similar to that of the bison. It was in the Bialowieza forest that the last free-ranging specimen died in the 19th century, but it was also in Bialowieza that the first tarpanlike horse (p. 67) was bred in the 20th century.

Like their more famous cousin, Przewalski's horse, tarpans were descended from an ancient forest-dwelling animal similar to the tiny, fox-sized *Eohippus* (SMITHSONIAN, March 1974). They roamed the plains and forests of Central and Eastern Europe and Asia.

The tarpanlike hybrids being bred today are mousy-gray; the Przewalski's are more of a yellow-reddish dun. Apart from color, though, both of these early versions of *Equus* share many similar features: a size roughly between a modern horse and pony, a dark stripe along the spine between tail and mane, and dark "slash" markings on the lower legs.

Whereas Przewalski's horse found its last refuge on the plains of western Mongolia, the forest tarpan sought a precarious safety in the woodlands of Europe, gradually adapting to the less rich grasses there.

Strictly speaking, it is incorrect to call Bialowieza's horses tarpans. True tarpans are extinct. Some of their genetic material survives, however, in the animals at Bialowieza. These are the descendants of hybrids that resulted when true tarpans bred with farmers' domestic horses over several centuries.

Bialowieza came into the picture between the World Wars, when Tadeusz Vetulani, a Poznan University zoologist, collected several of the most primitive-appearing hybrids and began selectively breeding them to "remake" the tarpan. He chose Bialowieza as a site on the simple logic that since the forest had harbored the last wild herds, it would be the logical place for the new ones. Gradually, over several generations, tarpan characteristics began dominating those of the hybrid. During the long years of occupation the Germans sent most of the herd back home for their own breeding experiments. Of the 33 transported away from the forest, about half survived the war. The Poles painstakingly tracked them down in Germany and brought them back to Bialowieza, where the selective breeding was resumed.

Today, most of the animals have left Bialowieza. The dozen that remain there, in captivity, serve mostly as tourist attractions, side by side with some penned bison. The greatest part of the herd has been given a home in the lake district of Masuria, about 130 miles to the north. On a peninsula jutting into Lake Sniardwy, the biggest in Poland, the horses of the Popielno Research Center of the Polish Academy of Sciences enjoy the tender ministrations of Magdalena Jaworowska, the deputy director in charge of their health and well-being. It is difficult to imagine a mother caring for her children more devotedly than she does for her four-legged charges, and she never tires of enumerating their virtues.

"They are strong and healthy and have good hooves," she said. "They are fecund, long-lived—(up to 30 years),—good-natured, excellent for riding, very willing to work and economical on top of all that. Two of them will eat less than a big workhorse, but together pull a much bigger load. They are an ideal, all-purpose horse for the country. For work, transportation or just pleasure riding."

The adult horses at Popielno have a flat-lying mane rather than the erect, bristly one characteristic of the true tarpan, and are slightly bigger as well. Their general shape is the same, though, as is their mousy coloring and the trademark of the dark stripe along the spine and the slash marks on the lower legs.

"Many people make the mistake of calling these horses tarpans," she observes, "but they are in error. The tarpan is extinct and we cannot come any closer than what we have now. What we have achieved is a race of small, primitive horses which have many qualities of the tarpan."

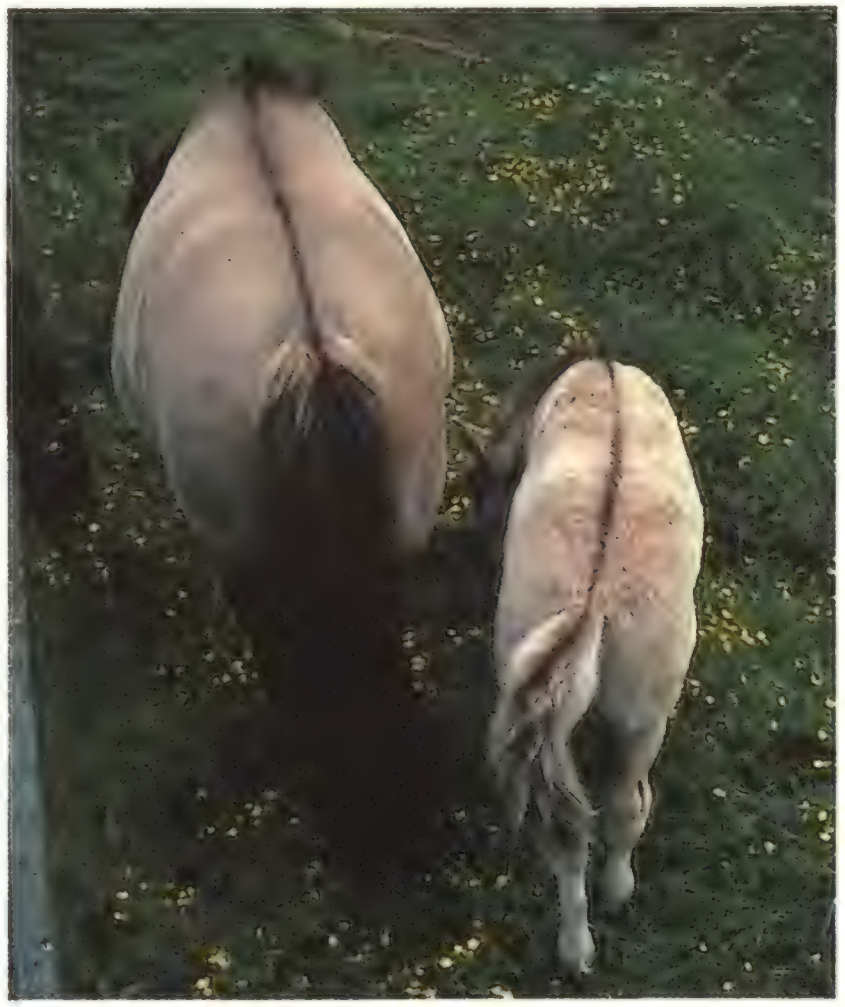
The majority of the Popielno horses are fully domesticated, living in stables, provided with food and even, on occasion, pulling buggies or farm wagons. But 27 of them, in three independent herds, are left to fend for themselves throughout the peninsula. The idea is to keep them in an environment as close as possible to that in which the wild tarpans lived.

There are now about 200 "tarpans" in Poland, distributed between Popielno and other small breeding stations, all of them carefully charted and pedigreed. Only a few pairs have been exported: to Canada, West Germany, Finland, Belgium. As is the case with the bison, the total herd is still considered too small, and governmental policy is to increase the family before any more sizable exportation is considered. Once a comfortable number has been achieved, though, there is no reason why the primitive Polish horse could not be sold widely abroad—on the contrary, such sales will be encouraged in the future. Miss Jaworowska suggests that their readily manageable size, their sturdiness and equable temperament would make them ideal companions for children.

Heartwarming as the image of children on the back of a primitive horse may be, there are more profound reasons for wishing to increase the herd. They are like an imperative in the Polish racial memory by now, urgently recommending a policy of multiplication and dispersal. Dr. Czeslaw Okolów, who, in addition to his duties as chief scientist, runs the Bialowieza museum and acts as historian for the forest, the bison and the horses, is wary of the future.

"What we have done," he says, "is to take mixed descendants of the tarpan and breed back to something very close to the tarpan itself. This has given us primitive genetic material which may be used for rebreeding future strains. It is, you might say, like a fount."

With the Germans on one side and the Russians on the other, Poland even now can never be entirely sure of the future. It is best to be prepared.



The dark stripe along the spine of these tarpanlike hybrids was a characteristic of the true wild horse.

Stiff manes on these four-month-old hybrids give them appearance that comes close to wild ancestors.

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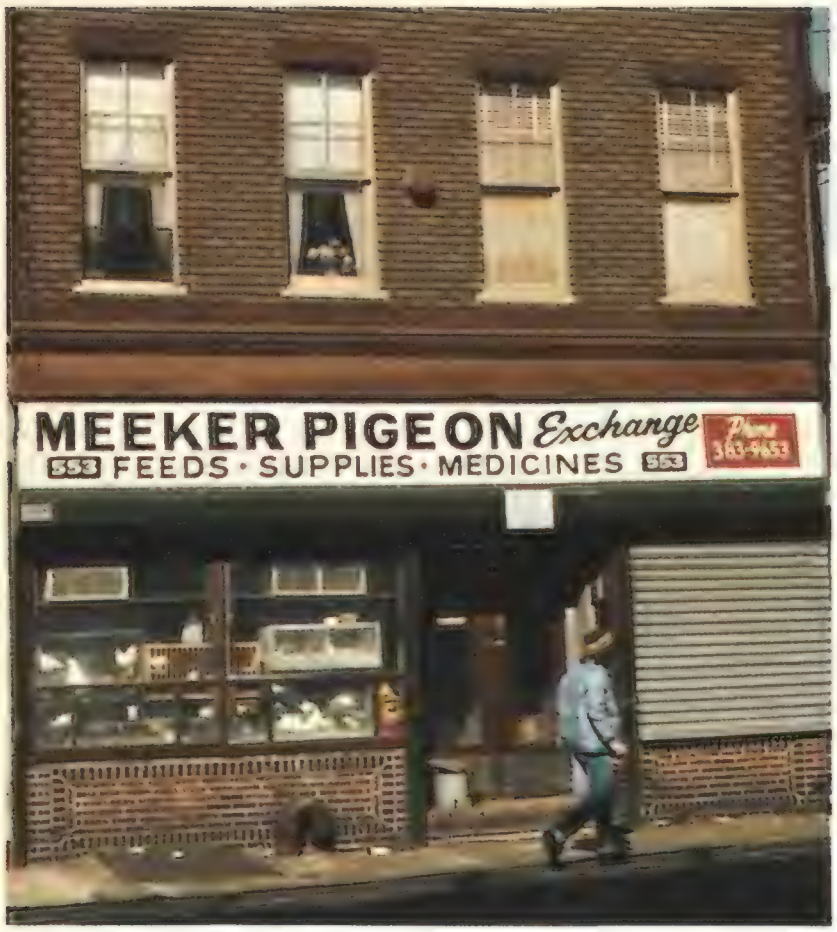

Headquarters for *la guerra,* the Meeker Exchange is where mumblers go for birds and comradeship.

To Pat Sottile, the store's owner, the cooing of pigeons "is music to your ears, really."

By Jack Kligerman

'Pigeon mumblers' of Brooklyn wage guerra *in the skies*

In Greenpoint's battle over the rooftops, fanciers maneuver their birds against 'enemy' flocks—and take some prisoners

From *A Fancy for Pigeons* by Jack Kligerman. Copyright 1978 by Jack Kligerman. By arrangement with Hawthorn Books, Inc.

Flying his hands like an off-duty fighter pilot, Vito Capobianco talks tactics with moustached Allan Richman and others. Exchange draws fanciers from across the country, but most come from Brooklyn.

At the corner of North Henry Street and Meeker Avenue, on the southernmost border of the Greenpoint section of Brooklyn, facing south in the shadow of the Brooklyn-Queens Expressway, stands the Meeker Pigeon Exchange. Although this store gets its share of sunlight in the summer, it is only in autumn, when the late afternoon sun moves northwest of the highway, that the storefront lights up and the pigeons in the window glow with a special kind of grace. They are beautiful birds, among them the show breeds such as Kings, Tumblers, Nuns and Show Flights, and a sprinkling of some favorite Racing Homers bred by Pat Sottile, the store's owner.

Behind the window, inside the store—or outside in good weather—drinking beer or the free coffee, buying feed, arguing over birds, speaking in their special argot, range the "mumblers" or "mikes," as Brooklyn's pigeon fanciers call themselves. And behind them, cooped along both walls in the back room, are hundreds of pigeons. These are generally Flying Flights, the warriors of Brooklyn's roofs.

Though few people are aware of it, the flocks of pigeons one sees while driving along the Brooklyn-Queens Expressway in the vicinity of the Meeker Pigeon Exchange are actually in combat, or at least on maneuvers. The "Flight guys," those mumblers who specialize in this pastime, send their Flights in "flocks," "stocks" or "bundles"—all synonyms—above the roofs of New York City, where they form squadrons in a many-fronted war. The object of each daily battle is to capture pigeons that belong to your "enemy" on a neighboring roof or to bring down any stray, but well-bred, pigeon that happens by.

The Meeker Pigeon Exchange is the unofficial headquarters for this battle of the skies. The store is Pat Sottile's world. It is his place.

I had sought out Pat Sottile because I had heard he would be a good guide to this extraordinary sport, and

Photographs by Alfred Eisenstaedt

From the roof of the Exchange, a bundle takes off to do battle with enemy flock airborne in distance.

When flocks mix, each mumbler will signal his birds to return, hoping they will bring back captives.

when I met him I was not disappointed. A tall man in his late forties, dapper in a denim suit and patent leather shoes, he sported one of the most knowing smiles I had ever seen. He seemed crafty in a good sense and worldly-wise. His father's parents came from Palermo, Sicily, and his mother's from Naples. As Pat says of himself, "I'm a mixture. See, they say all Sicilians are bad. I'm only half bad, so to speak." The Eldorado he drives goes well with his suits, but he is not beyond sitting on the stoop in jeans, cigarette in one hand and a beer or coffee in the other, talking to the mumblers who frequent his establishment.

The atmosphere of the Exchange is one of warmth and comradeship, but up on the roofs, Pat explained, the game is called *la guerra,* the war. "On the roof, you are natural enemies," Pat said. "In the street you're friends, but up on the roof you don't talk to each other. It's dog-eat-dog on the roof. You raise up your flock? I'm gonna raise mine up right afterwards, to try and get yours. With a Flight guy, if you leave out a hundred today, by the time you lock them up tonight you may have only 20. We're gamblers. We're go out there, maybe we'll lose 80 or we'll catch 80. We are in there to lose or to catch."

The immediate origins of *la guerra* in Brooklyn go back into the 19th century, when waves of European immigrants—Poles, Jews, Lithuanians, Russians, Italians like Pat's grandparents—came to take up blue-collar jobs in New York. These immigrant groups shared one love: pigeons. Today Greenpoint retains this ethnic mix, and indeed in the Meeker Pigeon Exchange the youngest mumblers—Pat does not allow them inside until after school hours—are Puerto Rican. Greenpoint's houses, most of which are more than 75 years old, are well-kept and not unattractive. Families of several generations still live in many of them and keep their old-world customs, including their pigeons. The continuity must be comforting. For the pigeon mumbler it does not matter that there are only two substantial parks in Greenpoint. No one owns or zones the sky.

It is common for mumblers to start young, and indeed Pat Sottile thinks the word "mumbler" stems from the fact that many boys who raised pigeons were what we call today "slow learners" and mumbled when called upon in school. Pat himself became involved with pigeons in the 1940s, when he was 11 years old. "I remember sitting in the classroom," Pat said, "attempting to do my schoolwork, and I'm gazing out of the window of the school looking at pigeons, because there's a fellow had them right across the street from

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the school, and I'd be watching his pigeons flying instead of doing my schoolwork."

I first went myself to see pigeons flying with Allan Richman, who runs the store for Pat. Allan comes across as a pleasant person, quite some years younger than Pat. He sports a full moustache and speaks superb Brooklynese. Allan led me upstairs, and then up a ladder to the roof of the Exchange. It was quiet. A cold wind blew strongly from the northwest, and the sun, now almost yellow-orange with a kind of magic light, was setting slowly out beyond Manhattan. It was still overcast, but the sun had moved below the cloud level. Wherever we looked, bundles of pigeons were hooking (angling sharply into the wind) or rolling (turning wider) away from their respective roofs. Their bellies and the underside of their wings flashed brightly as they hooked. Allan opened the coop, picked up a 15-foot bamboo pole with a piece of red cloth on the end, and "booed" the pigeons into the air.

The whole scene—the quiet broken by the sudden flapping of wings, the rooftops, the light and the feel of the wind—imprinted itself on my mind. I began to understand Pat Sottile and his fellow pigeon mumblers. Strangely, for a moment I was not sure whether it was Allan who controlled the pigeons or if it was they who had the greater power. But that October afternoon on the roof of the Meeker Pigeon Exchange made me ready to understand what Pat meant when he later said, "On the roof you're away from sounds, you're away from people. You don't hear nothing but the cooing of the pigeons. That's all you want to hear, you know. And if you love the game, there's no other life, you don't want to know no other life."

Such tranquility, of course, is only one part of the game's appeal. Another is the challenge of training a flock. No two mumblers use the same method of "breaking in" a bundle of pigeons, but Allan Richman's way is probably as typical as any. Sometime in the month of May, Allan takes his fledgling pigeons and puts them into a group of 20 to 30 which he calls a "team of routers," and chases them off the roof with a long pole or even a handkerchief, whichever is handier. Once or twice a day he does this, making sure the pigeons have not had anything to eat beforehand. The young pigeons fly as a group straight out from the coop and come straight back, where they are rewarded with the usual means of simple conditioning: food. Each day, as the pigeons get stronger, they fly farther and farther from the coop, getting to know each other in the process. This last point is not as farfetched as it sounds. In training pigeons, one relies heavily on what is called the "kit pull" or "flock pull" instinct: the tendency of pigeons to stick together closely in the air. Actually the flock pull is a protective behavioral adaptation, since the hawk, one of the chief predators of pigeons, singles out individual birds as its intended prey. It is more difficult for the hawk to make a successful strike when the flock stays together. The mumbler watches his stock carefully as it flies, noticing in detail the characteristics of each pigeon. Birds that tend to stray from the main group are quickly taken from the flock and brought to the Pigeon Exchange. Or they meet with a harsher fate and are "culled"—selected out and neatly done away with. By September, a five-to-six-mile "fly" is normal for the routers.

It is only then that Allan will take the young pigeons and let them fly with his main bundle. Here they quickly adapt to the maneuvers of the experienced

In the Exchange mumblers drink beer or—like Mike Capobianco at right—ruminate about pigeons.

birds, primarily the hooks and rolls which are the basic turns of Flying Flights. The mumbler knows the new pigeons have "settled down" and have got to know the old birds when they all stick together. One skill that Allan looks for in his new birds is their ability to turn on their backs and "butterfly right down" to their coop when given a signal—a two-finger-in-the-mouth whistle. It is the butterfly movement that will enable the birds to "knock down" another mumbler's pigeons after two flocks have mixed. The quicker a stock butterflies when given the signal, the greater the chance of dropping the enemy's birds down on the roof, where they can actually be captured. When you manage your stock so that you "knock your pigeons down" on those of another, the birds hook sharply over the coop, turn on their backs, and bring the strange birds down with them. According to Allan, "it takes a good pigeon" to escape such tactics.

A true pigeon mike relishes the risks that go with the game. The mumbler, whose birds today may cost him from one to three dollars each, takes a big risk each time he raises up his stock over the Greenpoint roofs. The sight of a mumbler chasing up his stock in early autumn seems the perfect illustration of "throwing money to the winds."

One day when I was on the roof, I watched two flocks mix some distance above me. Both groups were hooking in tight formations, neither flock breaking the circles that only well-selected stock and good training combine to create. The nearer flock, the one belonging to a mumbler named Gus, was spiraling slowly higher, while the other seemed to be on its way down. With each revolution the flocks grew closer to each other and the excitement on Gus' face grew in intensity. There was a moment when the hooking of both flocks brought the pigeons together and the mixing was complete. The outlines of each group grew fuzzy, the direction of the movement was broken, and the two distinct formations became a confused jumble. Almost at the same time as the flocks "crashed" the mumbler let out a mellow whistle and called his birds down to the coop. He threw out some grain and watched as the flocks separated, leaving stragglers spread across the sky. The birds dropped down fast to the coop, but this particular time no capture was made. If the mumbler had recognized any unfamiliar birds among those settling on his roof, he would have edged over, grain in one hand and a long-handled net called a "hoople" in the other. Taking the unwary and confused bird by surprise, he would have "slammed 'im" with the net and captured the prize.

La guerra has its own rules, a number of which have to do with exchange of prisoners—that is, what to do once one has one's enemy's pigeons in the coop. Four variations govern the exchange in Greenpoint: a free catch, where a person gives the pigeons, identified by colored plastic bands on their legs, back to the original owner for free; an exchange according to treaty or agreement, whereby one haggles with the enemy over the cost of redeeming each prisoner (the going rate today is one dollar); catch-keep, where a pigeon is shipped out, say, to the Bronx, so that it stands little chance of ever getting home; and catch-kill, which is self explanatory and only used when one pigeon mike,

Above, a Flight guy examines a pigeon's wings before buying, while a Homer guy weighs purchase of a pair of Racing Homers. At right, a mumbler called "John the Polack" savors convivial atmosphere.

With the Empire State Building in the distance, Flying Flights circle rooftops of Greenpoint.

as Allan explains it, "has really got it in for another."

They did not invent these rules in Greenpoint, however. They go back at least to the 16th century, when the game was played in Italy. In Modena, a center of the sport, similar rules governed the prisoner exchange. There catch-kill was known as *la guerra ad ultimo sangue*—war to the last drop of blood—and the captured pigeon was customarily hung from the victor's balcony in full view of the enemy and there dispatched. One variation of *ad ultimo sangue* is worth mentioning because of its incredible ingenuity. A victor would take a captured pigeon, attach to its leg a small, carafe-shaped glass bottle filled with gunpowder and armed with a fuse sticking out of the neck. He would wait until his enemy—*il nemico*—raised up his pigeons again. Then, relying on the kit pull instinct, the captor would light the wick, release the pigeon, and watch the flying bomb explode in the midst of his enemy's stock.

Ad ultimo sangue, admittedly without its refinements, has not yet been forgotten, as Pat's term "catch-kill" signifies. Pat says, however, that he has never played the game this way. He stops at catch-keep, which he describes with his own characteristic animation: "Catch-keep means if I catch one of your pigeons, no way you're gonna get it back. No way. I'm gonna sell it to somebody at a distance, where you'll never see it again."

A game older than the Talmud

Though European immigrants brought *la guerra* to the United States, the game probably did not originate in Europe. Chances are that it spread both into Europe and into India and China out of the Middle East. It was practiced in Palestine before the sixth century A.D., for reference to catching other people's pigeons appears in the Talmud. Indeed, the Talmud mentions "fliers of pigeons" among those disqualified to act as witnesses in trials—presumably because they were gamblers, and therefore considered untrustworthy.

Just how the game spread is unknown. But wherever it has appeared, it has been played in surprisingly similar ways, described in similar terms and represented in similar images. Moreover, it has been played not just by classes analogous to Brooklyn's blue-collar pigeon mikes, but also by royalty, or at least by agents of kings. At the Smithsonian's Freer Gallery of Art in Washington, there is an illustrated manuscript page, circa 1590-1600, portraying the Emperor Kublai Khan, his empress, his court—and his keeper of pigeons.

As the game is played in Greenpoint, the ultimate thrill is "crashing" an enemy's stock and "cleaning up on him"—"really doing a job on his pigeons," as Allan says. A mike might be especially pleased if the birds he

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captured belonged to a "keystone," a "dogcatcher" or a "mutt"—those who risk little with their flocks and keep them above their home coops, wanting only to be on the receiving end. Allan speaks with humorous scorn, too, when he mentions a "zorro," a mumbler who never raises his flock up at all but keeps "poking" or "flattering" his birds with the long pole, just enough to get them to fly from the roof to the top of the coop and back again, luring strays down without risking one bird. The flapping motion of a pigeon's wings as it lands is often enough to entice other pigeons to come down. (Netters of the now-extinct Passenger Pigeons also used live decoys to capture wild birds.) Some pigeon mikes might even fudge occasionally on their treaties and keep a superior bird in violation of his agreement with an enemy. Say a man has a pact with another to exchange birds for a dollar each. If he sells back all the birds but the best and keeps these for his own pleasure, then he is said to be "schmocking" the other guy or pulling a "schmock job."

For Flight guys, the time of greatest excitement is autumn. The strong northwesterly winds that sweep across Manhattan and blow summer's smog away from the roofs also blow stray pigeons around and edge whole flocks farther away from their home coops. It is the time when the young birds go up with the old and get their best training. Now are the "action days," says Pat. "Everybody waits for that, you know . . . that's when you get ripped apart." During autumn a pigeon mumbler in Greenpoint might get up on the roof as early as six in the morning every day to watch the action and raise up his stock when the time is ripe. Pat knows one man at the store who lost 107 pigeons in one day. And somebody caught them. "Naturally the guy that caught them had a bonanza. You know, he had $107 made for the day which ain't a bad day's pay."

There you have Pat Sottile, Greenpoint, and the Meeker Pigeon Exchange. Pat considers Greenpoint "a decent area, a nice area. It's not ruined yet. People are building little houses there. There's a lot of churches in that area. I don't get to go in them, but they're around. Yeah, that's the story of Greenpoint. It still has a reputation for pigeons, Greenpoint."

Brooklyn is a long way from wherever it was in the East that people started domesticating pigeons, back in the invisible and unrecorded past after the last ice age. And the pigeon mumblers who keep watch on their roofs in Greenpoint and talk about, argue about, pigeons over coffee in the Meeker Pigeon Exchange are a long way from the old sultans who used to range the Middle-Eastern countryside, taking with them both their seraglios and their pigeons, the latter numbering in the tens of thousands. Yet whatever it was that fascinated those sultans hundreds of years ago still continues to exercise its charm today on the roofs of Greenpoint.

Perhaps a kind of symbiosis has existed between people and pigeons ever since the latter were first domesticated. Nature, after all, has curious ways of perpetuating its kind. We all, looking at it this way, play our bit part in praise of pigeons: Pat Sottile, you, Greenpoint's pigeon mumblers, myself. As for me, I am grateful for having climbed that ladder in Greenpoint to emerge through the skylight under a late afternoon sky into a cold autumn wind, to watch pigeons hooking high above.

Returning from a mission, pigeons settle on the roof. Flying Flights are identified by white wingtips. "Street rats"—the mumblers' term for ordinary city pigeons—may or may not show white in wings.

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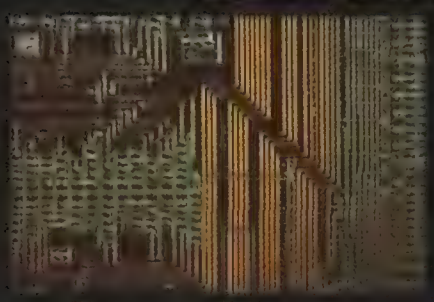
Technology this advanced deserves its own word.



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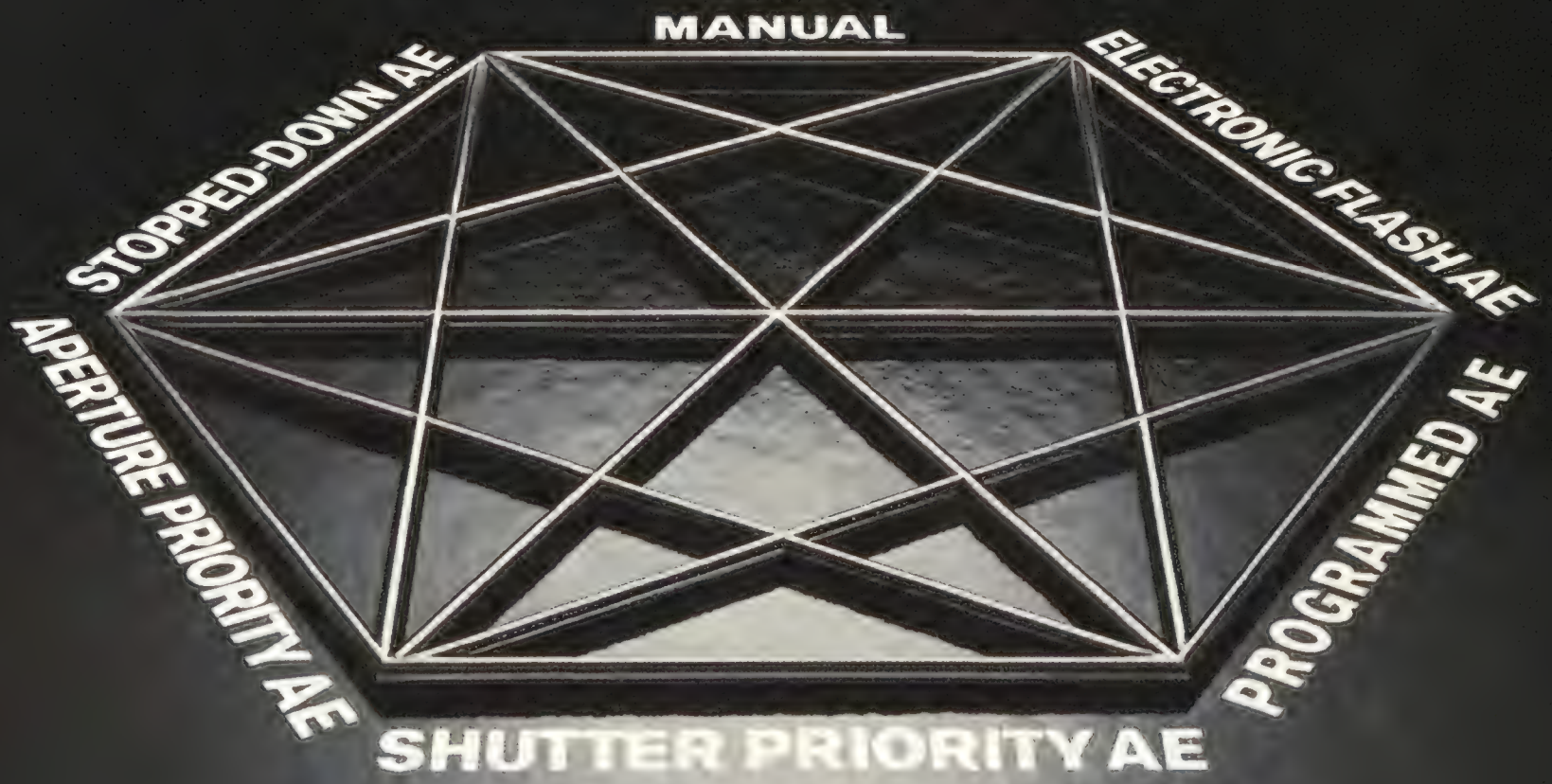

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"This is the set where they shot 'Hello, Dolly!' What you can't see is us pumping oil behind it."

"One of the strangest places I ever produced oil," says Gulf Production Superintendent Eddie Culbertson, "was right here in Los Angeles in the back lot of the 20th Century-Fox studio.

"We showed them how they could have their oil *and* their movies."

"They found a big oil field right under a permanent set being used for shooting the movie 'Hello, Dolly!' in 1969.

The indirect approach

"How do you get at the oil without disturbing the set, the streets, or the buildings? With a technique called directional drilling. The oil is under the city as far away as one mile from the surface location of the drill sites, which are hidden by the scenery.

"Directional drilling has other advantages. You can drill 20 or 30 wells from one drill site instead of filling the landscape with oil derricks. Or you can drill for some offshore oil without putting the drilling rig right in the water.

"Behind the scenery are 22 producing oil wells."

Keep America beautiful

"Sometimes it's a real challenge getting the oil without spoiling the landscape. Directional drilling is one way to do it. There are many more.

"Getting the oil out and preserving the environment is a challenge, but I'd say we were meeting it very well."

Gulf

Gulf people: meeting the challenge.

Main intersection at a Hollywood oil field.

Gulf Oil Corporation

Article and photographs
by Dr. D. Bradford Macurda jr.

These reef animals blossom at night

After 170 million years, the flamboyant feather stars are doing better than had been thought before their nocturnal activity was discovered

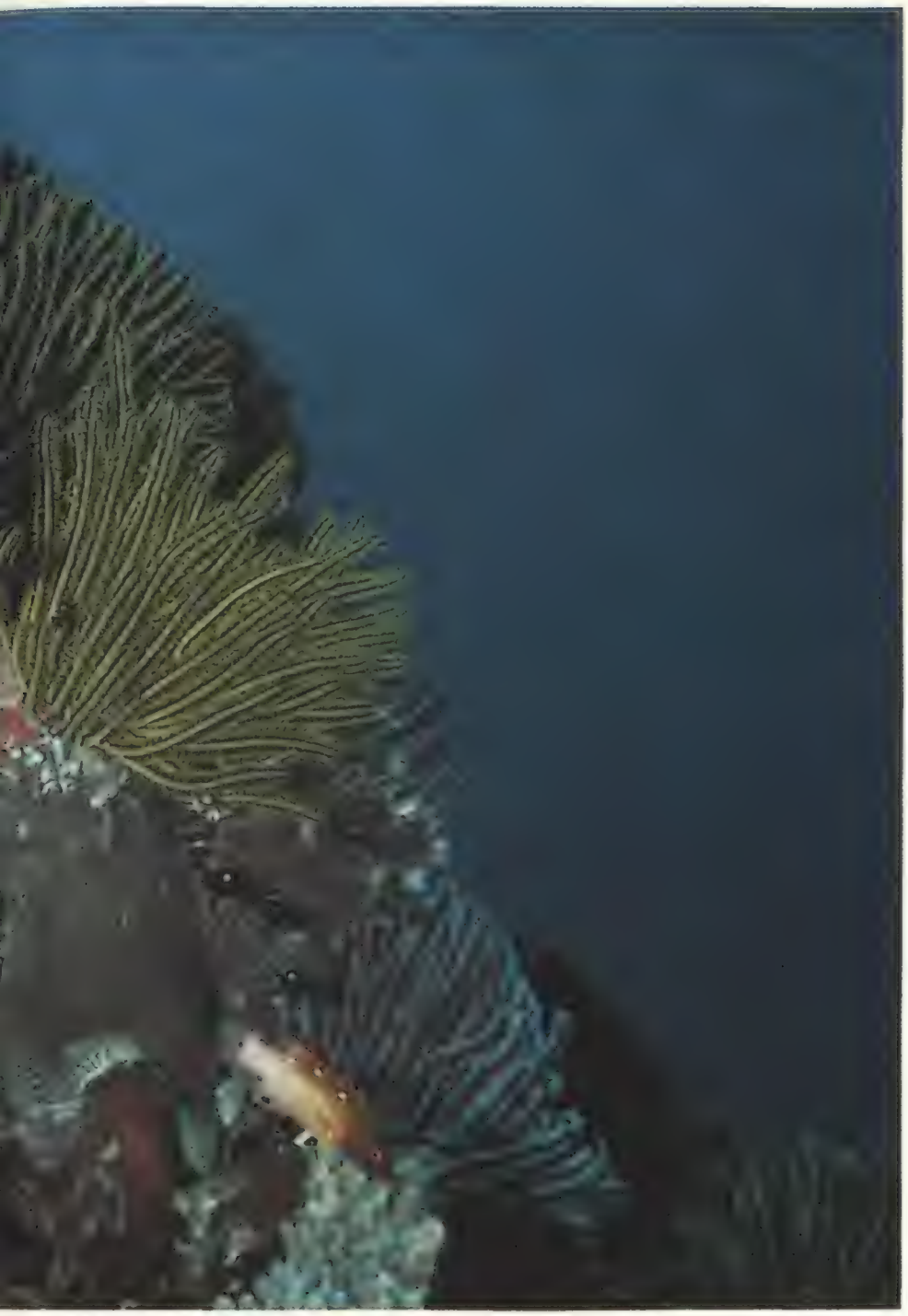
A bouquet of feather stars—actually they are animals, not plants—adorns coral knob on Indonesian reef.

With their outstretched arms waving in the current like branches of a plant waving in the wind, the feather stars on these pages are actually a class of animal that live on tropical reefs around the world. They were thought to be dying out and no longer important in reef ecology, until night diving by scientists revealed that, though they may be rare by day, by night they pack reefs in dense aggregations.

The feather stars are doing well, and have been for at least 170 million years. Their ancestors, the sea lilies, can be traced back more than 500 million years. A bottom-dwelling animal developed a stalk analogous to that of a flower; the stalk elevated the animal's body above the sea floor. Arms grew outward from the top of the organism; an internal skeleton composed of calcareous plates supported the tissue. Sea lilies proliferated: their skeletal debris forms thick layers of limestone today. Many became extinct at the end of the Paleozoic era, 230 million years ago, but some survived. Over the eons one group of sea lilies lost the stalk and replaced it with clasping structures, thus giving rise to the feather stars. During the last 170 million years, feather stars have subsequently evolved and diversified into the colorful fauna that now crown modern coral reefs.

The arms of a feather star can be compared to the links of a chain. The calcareous plates which support the tissue are bound together and articulate with one another by means of muscles and ligaments. The body of the animal, located at the juncture of the arms, is supported by a few large plates which are tightly tied together. One of these plates gives rise to the clasping structures, the cirri, by which the feather star can grip rocks, hard or soft corals or algae. The animal cannot use the cirri to move itself, but their tenacious grip prevents the feather star from being dislodged by strong currents or storms.

Most complex are the arms. In simple forms there are only ten arms, but some species have evolved more than a hundred. The juveniles of these multiarmed species start off with ten; new ones are added by dropping the earlier-formed arms and adding two or more in place of each cast-off one. Additional branches, called pinnules, spring from the upper surface of the arms and these support the food-gathering apparatus, the tube feet. These are tiny fingerlike extensions coated with mucous. Suspended food par-



Most of these are color variations of a single species; other species are shyer than this, even at night.

This similarly colored fish will spend much of its life camouflaged within Palauan feather star.

ticles, such as algae or larvae, carried in water currents are caught in the mucous and then conveyed to the animal's mouth.

The first significant observations of feather stars were made in the Red Sea in the early 1960s by German and Israeli scientists. David Meyer of the University of Cincinnati began a research program on Caribbean feather stars while at Yale University in the late 1960s. His work sparked my interest as a student of ancient crinoids (the class that includes both sea lilies and feather stars), and together we undertook a detailed study of living West Indian crinoids. Specimens we took for study will become a permanent part of the Smithsonian Institution collections.

In the mid-1970s we expanded our research effort, studying feather stars from Taiwan in the north to the Great Barrier Reef of Australia in the south, and from Fiji westward to the shores of eastern Africa and the Red Sea. More than 30 species coexist on one small part of the Great Barrier Reef; as many as 14 species have been counted on one coral head. Each species shows adaptations to living in certain parts of the reef. Most visible are those that perch atop coral heads in shallow water and fan out their arms in a semicircle to filter the passing water. Other feather stars prefer more elevated living sites, clinging to wirelike soft corals which arch above the reef. Still others are reclusive, hiding the body within crevices in the coral so that only the arms are visible.

Feather stars can move about. About half of them crawl, extending several arms in one direction, then pulling themselves forward while arms on the opposite side push. Others swim by pushing arms downward like the slow motion uncoiling of a lash in a remarkably graceful motion. Each arm will complete a cycle of motion approximately once per second; some crinoids with up to 80 arms can swim. Swimming is done within one or two meters of the bottom, and several minutes of swimming are followed by several minutes of rest.

Any animal that lives in an exposed position on a coral reef is in danger. Feather stars often have broken tips on the arms, but the spiny surface of the arms and relative lack of tissue probably serve as deterrents to predators. The body of an exposed feather star is protected by a series of sharp, stout pinnules that are like

A paleontologist at the University of Michigan, Dr. Macurda has studied feather stars and sea lilies in the West Indies and Indian and Pacific Oceans.

the dense field of spikes used to protect ancient moats around fortifications. (The name of their phylum, echinoderm, means spiny skin.) The dense tangle of arms and pinnules in turn provides a haven for many small animals. Some fish live their entire lives there.

Extreme color variation can exist in some feather stars. Every color in the spectrum is used by these, from greens and blues through orange and reds to yellow; some are also white. As light passes through sea water, it is gradually shifted toward the blue end of the spectrum, muting the color we see when the animal is photographed with artificial light. In a given species, one color variety will dominate at one site while a different color will be dominant at another. Dark red pigment is usually indicative of a nocturnal feather star. The chemistry of their pigmentation is complex, and its significance is unknown. Thus the reason for the beauty of these harlequins of the reef is so far an unsolved riddle.

This species spends daylight hours curled up in whatever crevices it can find on a Pacific reef.

Alarmed by approach of the photographer, it uses its arms to crawl from danger; other species swim.

At night, this feather star comes into its own, spreading its arms to capture whatever food there is.

OPERATION DOUBLE IN THE LAKE STATES.

Paul Bunyan was a legend.

But the huge harvest and regeneration of the mighty forests that gave birth to that legend is a fact. More, it is a practical lesson in the *economics* as well as *ecology* of the forest.

The story spans a century and deals with social and economic perceptions as well as forest ecology. And it illustrates the difference between turn of the century *logging* and modern *forestry*.

A hundred years ago this was the land of the Big Swedes and rough logging camps. The Great Northwoods. Loggers came to cut what they needed and move on. In terms of the times, this seemed no great evil. After all, "forests were endless." There were no incentives to stay and replant. Supply exceeded demand tenfold.

Enter Conservation.

But the forests weren't endless. And by the 1920s the best timber in the region was gone.

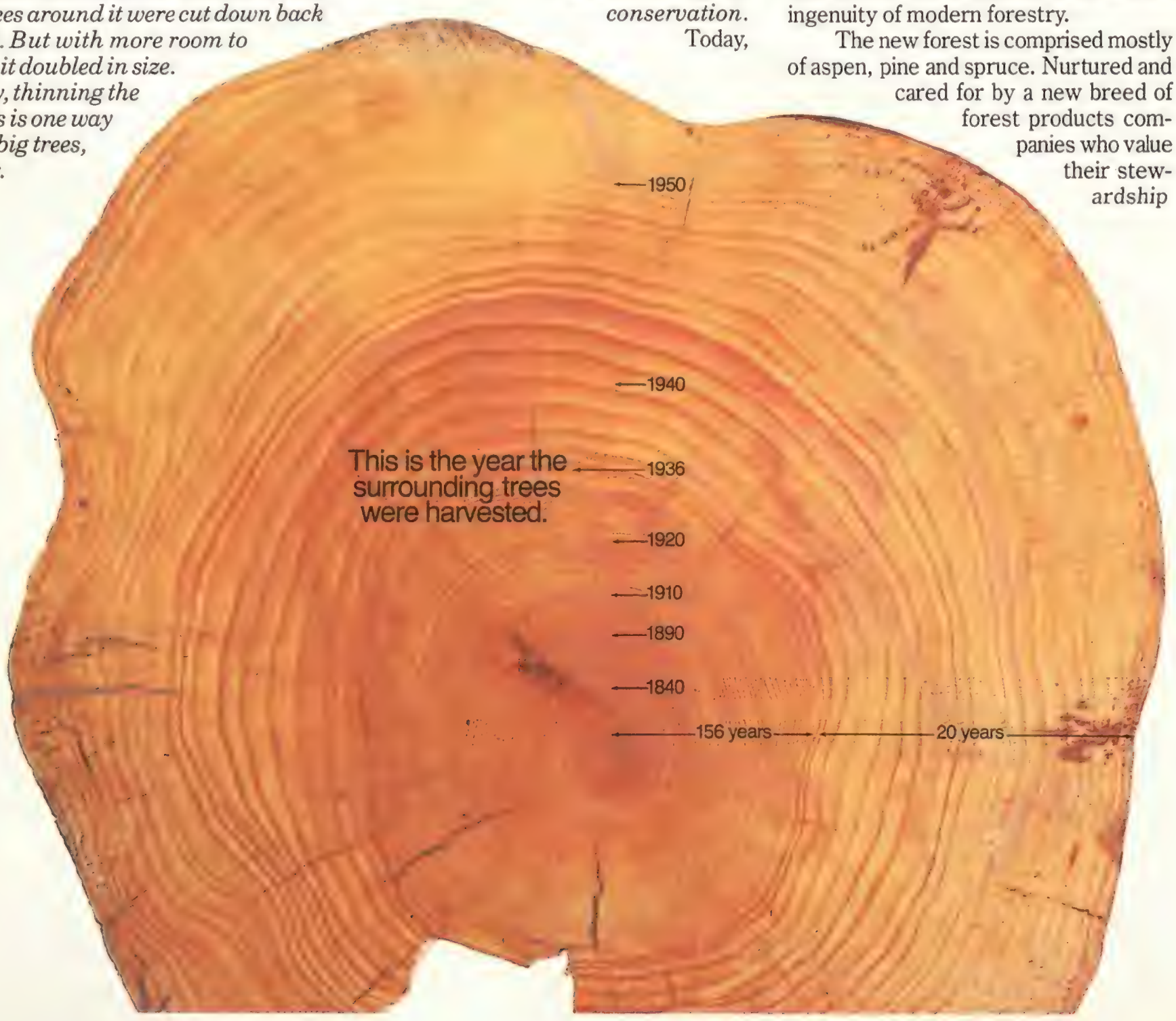
But if the 30s marked the end of one era, it also signaled the beginning of another: *the age of conservation*.

Today, much of the forest is making a comeback, thanks to the resilience of nature and the ingenuity of modern forestry.

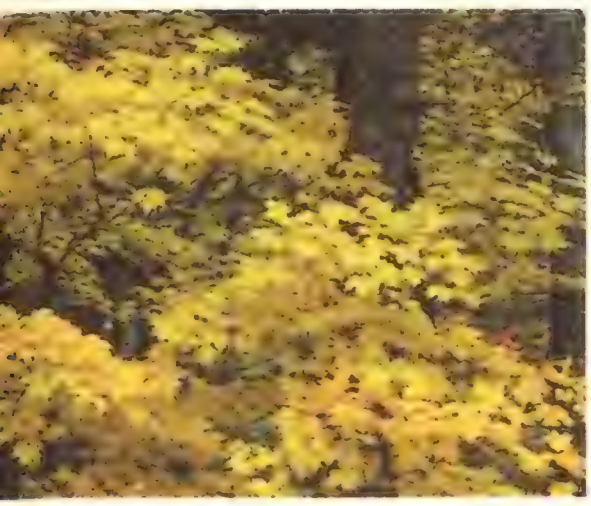
The new forest is comprised mostly of aspen, pine and spruce. Nurtured and cared for by a new breed of forest products companies who value their stewardship

Today, Paul Bunyan's forests are thriving.

After 156 years, this Eastern Hemlock was still too small to harvest when the trees around it were cut down back in '36. But with more room to grow, it doubled in size. Today, thinning the forests is one way to get big trees, faster.



TREE IS WORKING



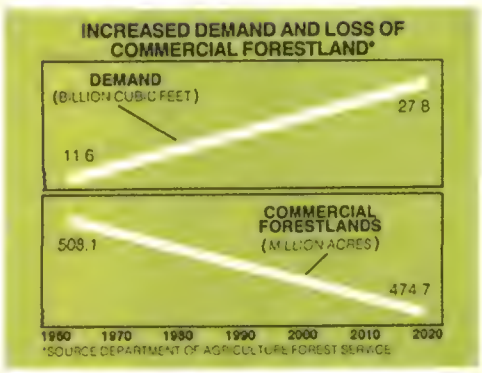
of the land. They plant, thin, fertilize and harvest. Little is wasted. Even aspen, once considered "weed," is now used for paper. In fact, nearly every part of every harvested tree is used, right down to the sawdust. And where natural regeneration is slow, foresters handplant the next generation of trees.

The result is a better quality forest. One that is actually more productive than Paul Bunyan's.

Operation Double Tree: Why it's needed and how it works.

In the U.S. alone, the demand for wood and paper products is expected to *double* in less than 50 years.

Yet today, only about one-third of this country's total forest is used to grow repeated crops of timber.



That works out to about one acre of trees for every man, woman and child. And each of those acres will have to be carefully managed to provide a lifetime supply of wood products.

Thus the reason behind Operation Double Tree—the forest industry's name for intensive forest management that can double the amount of wood grown on the nation's productive forestland. And do it in such a way that everyone can share in the benefits.

This is what Operation Double Tree is all about. But it's more than words. Here are some examples of how this practical brand of twentieth century conservation is working in the Lake States.

Managing The New Forest.

Item: In Minnesota, Boise Cascade gets more out of each harvest with a program that turns edgings, sawdust and other sawmill waste into useful wood by-products. Genetic research has even begun on the trees themselves, finding ways to make them grow faster and stronger. In the future these are the trees that will give us more wood, better wood, in a shorter amount of time.

Item: At the Cloquet Forest Tree Nursery in Minnesota, Potlatch is raising 250,000 seedlings a year in its greenhouse. Grown in small plastic containers, it takes the seedlings just six months to reach the size of two-year-old seedlings grown outdoors.

Now, instead of waiting several years for natural regeneration, foresters can promptly replant harvest sites and give the new forests a healthy head start.

Seeds for regeneration are collected by hand.

Item: In Michigan, Packaging Corporation of America is recycling the sludge from its own water treatment plant to use as a fertilizer on crops of hybrid aspen. The trees are planted in rows, carefully spaced for weed control.

Packaging Corporation foresters expect their methods to produce mature aspen in as little as 15 or 20 years, compared to the 50- to 60-year period normal for wild, untended aspen. The new aspen will not only be ready for harvest sooner, but will have a better quality fiber and higher resistance to disease.

Item: On Blandin Paper Company plantations in Minnesota, foresters and geneticists are working together to improve stands of trees. Using fast-growing white spruce on sites cleared of slower growing species, Blandin expects to double wood yield in the future.

A Long Way To Go.

So there's progress with Operation Double Tree in the Lake States, and in forests all across the country. But we still have a long way to go.

On the average, industry lands grow 50 percent more wood than the lands

We depend on trees for countless everyday products.

owned by government and private individuals. Yet, even here, there's room for improvement.

Overall, the American forest is only half as productive as it could be. And this is a waste. But by working together, all timber growers—private owners, industry and government—can learn to make the most productive use of our remaining commercial forests.*

Industry has invested millions to make the concept a reality. But money isn't enough.

Leaders and landowners alike must understand the problem. And, more important, the solution.

For information, write for our free booklet, "Managing the Great American Forest," American Forest Institute, P.O. Box 873, Springfield, VA 22150.

**Commercial forest is that portion of the total forest which is capable of, and available for, growing trees for harvest. Parks, wilderness and primitive areas are not included.*

Trees. The Renewable Resource.

By Edwards Park

Big Hole: still a gaping wound to Nez Perce

Site of a tragic battle in a useless war,
it recalls the end of Indian hopes
and first twinges of white man's guilt

You see the Park Service visitor center from some distance because part of its roof is shaped like an Indian tepee. The steep, pyramidal shape with an impression of lodgepoles jutting from its peak is unmistakable on a bare brow of Montana grassland. It seems to signify that Indians are deeply involved at Big Hole National Battlefield, that a sort of joint white-Indian victory is being celebrated here, that all is now forgiven on both sides, bugles have sounded Retreat, hatchets have been buried and hands are clasped in friendship.

Not the way I heard it.

I came to this pleasant site in western Montana on the 100th anniversary of the Battle of the Big Hole, a vicious set-to between a force of the U.S. infantry, beefed up by volunteers, and a band of harassed Nez Perce who were trying to start a new life away from their homeland over in eastern Oregon. I knew the skeletal scenario of the Nez Perce War: good Indians booted out of their ancestral lands because bad whites find gold; some bands refuse to sign unfair treaty; troops called up; fighting erupts; Indians flee toward safety in Canada; eloquent chief finally surrenders just short of goal—"... From where the sun now stands I will fight no more forever."

I never discovered the meat on those bare bones until I came to this spot where the pivotal battle of that little war was fought, in August 1877. Seeing the actual paraphernalia of both soldiers and warriors brought the battle home to me. Rifles, cartridge shells, a blue tunic, a buckskin jacket, an officer's footlocker and journal, a plug of chewing tobacco, a chief's coat, the dress of a rifle-wielding Indian woman—these and other objects formed a still life under that tepee roof. Photographs of stern Indians, fresh-faced young army officers and moustached volunteers lined the walls. And around me, as I inspected these mementos, gathered some descendants of the drama's original cast.

The white visitors seemed festive, talkative, reminiscent. The Indians did not generally pay much attention to the exhibits, for these are tangible reminders of a brutal massacre by the army, of a gallant recovery by the Nez Perce warriors that turned their adversity into victory, of the transience of that and other victories over the whites. Battles were often won—like this one—but all wars were lost. I saw no forgiveness in the older Indian faces around me.

Out on the parking lot the younger generations of Nez Perce were arriving by the dozen for the ceremony of this 100th anniversary. They unwound from station wagons and pickups and slipped on their costumes for the Indian dances that would be featured. They donned bright shirts and jackets that simulated buckskin; brilliant feathers that may or may not have ever been intimate with eagles; beaded belts and head pieces. There were splendidly athletic young men, lovely young women. "Where have they been for the last 50 years?" cackled a white oldster near me.

I quickly learned about the name. Around here, you don't say "Nay Pearsay" as in Quebec. This is Montana, and you call them "Nezz Purse." You say it fast with a touch more emphasis on "Nez."

Indian speaker at battle centennial is flanked by color bearers of Montana National Guard.

Looking Glass, supreme chief at Big Hole, joined Joseph after soldiers fired on his band. He was demoted after the fight because he had failed to set guards at the campsite.

Tragedy at the Big Hole

Joseph had promised his father to keep ancestral lands. Hence he resisted move to reservation.

They lived originally where Washington, Oregon and Idaho now come together. They lived in high valleys where they fished and hunted. Then (back to that scenario) gold was found by prospectors who had no right to be on treaty lands. Congress pushed for a new treaty which would cram the Nez Perce into less than a quarter of their former territory. Many chiefs signed it. Many did not, including Old Joseph, whose son, Chief Joseph, became spokesman for all the "non-treaty" bands.

Their modest resistance produced an ultimatum, then the army. Joseph had no intention of going to war, and by June 13, 1877, his and other nontreaty bands were moving toward the reservation. But three young warriors (drunk, according to one rumor) killed four whites, setting off days of raiding. In 1877, a year after Custer's "Last Stand" (SMITHSONIAN, June 1976), this started an Indian War.

One thinks instantly of bonneted warriors swirling around a wagon or a cabin, yelling and shooting and making suicidal dashes to "count coup." One thinks of them as armed with bows or repeating rifles whose use they misunderstood. One thinks of the cavalry arriving, bugles sounding the charge, hooves thundering, guidons snapping, carbines volleying with deadly effect. Those Indians who do not tumble from their Appaloosas flee over the next ridge, and the colonel in his dusty blue jacket reins up beside Miss Amanda's wagon and doffs his hat. "Well, Ma'am," he drawls, "I see we meet again."

Think instead of a painful procession of Indian families strung out along a hidden valley—women, children, old men, dogs, a huge herd of horses, lodgepoles, cooking pots, hides, sacred emblems—all moving with surprising speed toward some campsite where the water is good and perhaps some camas roots can be dug for food. All around this migration ride the young men, the warriors, well mounted and armed, sweeping the countryside to guard against discovery by soldiers and also to find supplies. If four or five of these Indian scouts find a settler's wagon or cabin, they may dicker for what they want. If the whites refuse to sell, the Indians may kill them. But you never can be sure. *Sometimes* the Indians kill first.

That's the way the Nez Perce War started. When the Indians were in the killing mood, as were the young men of June 13, they showed little respect for the Marquis of Queensberry. The raiders captured a party of whites that included a little girl. They hurried her along by jabbing her in the throat with a knife. When she cried, they cut off the tip of her tongue. "The poor mother," reads a report, ". . . was brutally outraged. . . ." Another added that her other child was killed "by having its head placed between the knees of a powerful Indian and crushed. . . ."

But in subsequent weeks, the Nez Perce were observed to be behaving in a way extraordinary for warring Indians, not scalping or mutilating bodies, even friendly. This was credited to Joseph.

The army, meanwhile, slogged along somewhere in the rear looking for a confrontation. In that summer of 1877, the army assigned to the Nez Perce area consisted of some units under the command of General

Edwards Park is a member of our Board of Editors.

T-ka-mappo, a Nez Perce woman, went through the Big Hole battle. Photograph was taken years later.

Yellow Bull, Nez Perce warrior and veteran of the Big Hole, photographed in 1912.

Oliver O. Howard, a one-armed Civil War hero with the brooding eyes of a religious zealot (his men maintained that he hated to fight on a Sunday). From this force two companies of cavalry struggled through the Idaho mountains after the nontreaties, thought to be following Joseph. The Indians eluded them as much as possible. Twice the troops caught up. The first time, they were cut to ribbons by deadly accurate rifle fire from warriors who dug in and took careful aim. The army fled the scene, and the Nez Perce slipped away with only three or four wounded. The second encounter started out the same way, but this time the soldiers were used better, and there were more of them —plus a mountain howitzer. So, after an indecisive battle, the nontreaties left.

For the time being, Joseph and his people gave up hope of a settlement with the whites. They crossed the Bitterroot Range and entered the buffalo country of Montana. Here they considered themselves safe, for the army had driven them from their homeland. At a pleasant valley they raised new tepees, rested, danced and didn't bother to post guards.

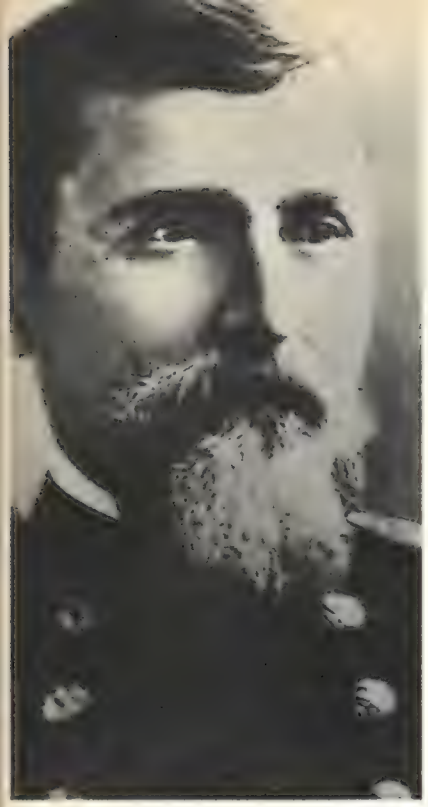
The picture window of the national park's visitor center looks down on that campground. It's at the edge of a sloping meadow where it meets a little stream, meandering through a willowy marsh. The far side of the marsh dampens the foot of a steep hill. The prairie-meadow is called the Big Hole, and the stream is the North Fork of the Big Hole River. The hill is called Battle Mountain.

Outside, on the lawn of the center, an Indian master of ceremonies with a voice like Bob Newhart's took over the public address system. "Could I have all the dancers over by the drum, please? All you dancers?"

Costumed Indians gathered, chatting, and the rest of us drew around to watch the performance. But first the MC had to introduce every one of the dancers. Scores of them, each with a biographical sketch and a little joke. My eyes glazed over. I recalled that in the movies Indians always talked at great length in council meetings. I wondered whether, in treaty discussions, the whites mightn't have become so overwhelmed by this weight of Indian rhetoric that they never really *heard* the Indian viewpoint. After a benumbing half hour, on that bright August morning, I slipped away to visit the battlefield.

I crossed the top of the prairie valley—the Big Hole —where Joseph's people had camped in 89 tepees. The horse herd, about 2,000 head, grazed on the steep hillside across the stream. A bridge led me over the marsh and onto the base of that hill.

I was now where nearly 200 soldiers, more than 30 of them civilian volunteers, had crept into position on a cold night. The troops were from the 7th Infantry under Colonel John Gibbon, a leathery veteran who had forced them on a march from Fort Shaw after



The men with Col. John Gibbon, left, at Big Hole, included young officers Hardin, Woodruff and Van Orsdale, shown in West Point class pictures, Capt. Logan,

Howard called for help. Gibbon's supplies were well in the rear. With them trundled a brass howitzer.

Now in this black night, Gibbon strings his men out along the base of the hill, facing the marshy stream and the campsite beyond. A few fires are dying. No sign of an Indian guard. At first light, at the sound of a single shot, the troops will pour three volleys into the camp, then charge across the stream.

The slope is steep enough so the men can lean back against it and get the weight off their weary feet. They want to light up pipes, but no such luck. No talking either. They check the "trapdoor" breeches of their rifles, heavy .45-70 Springfields. They check cartridge belts—90 rounds per man. They try to rest.

Then there is a stir in the mountain silence and adrenalin surges. An old Indian, partly blind and almost deaf, rides out of camp to see if the horses are all right. He crosses the stream and heads right toward the line of troops—shadowy in the dim light in their dark blue jackets and black slouch hats.

A bellow of shots. The old Indian topples. The dark line surges forward as the volleys crash. Then the soldiers are fumbling the next cartridge into place, cursing the shock of cold water as they slosh across the stream, trying not to fall on knobbly, spongy ground.

I followed them 100 years later, and even in bright daylight, minus rifle, haversack, cartridge belt, bayonet and canteen, I almost fell on two half-buried roots.

In the Indian camp, bullets crackle through the tepees, many of them killing and maiming. Young warriors with lightning reactions blindly seize rifles and dart outside. Women and children and old men do not move as fast, but blunder awake, bewildered. It is these the whites kill in the darkness as they reach the camp and shoot at everything that moves. Some soldiers challenge first, and let the women and children go, but many do not. The men are tired and keyed up—and these men had seen the Custer battlefield the year before—had seen what the Sioux had done to the troopers of the 7th Cavalry. Now they are doing the killing.

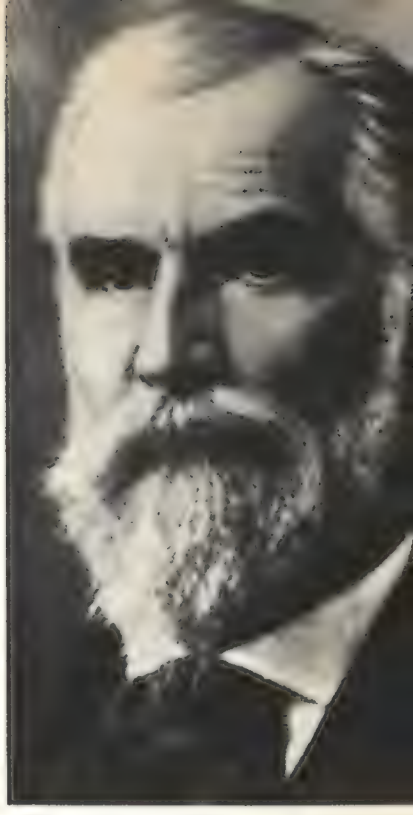
But the warriors, first to react, are rallying among willows. Soldiers trying, with little success, to set fire to the dew-wet tepees hear the the shouts of the war chiefs—White Bird, Looking Glass, Too-hool-hool-zote—and soon face withering rifle fire. Again, officers are picked off. Gibbon himself is hit.

Back scramble the troops to a wooded bluff that shelves out from the hillside. Here, they scrabble out rifle pits with canteen cups and a few newfangled trowel-bayonets. It may be their only place for a stronghold—but it's not much good. Indians creep within ten yards in order to do their killing, and shots, some from hundreds of yards away, sing into the huddle of blue jackets. The soldiers find that trying to fill a canteen in the stream is like facing a firing squad.

The battle roars on for all that long day, the troops pinned down, grimly aware of growing thirst and dwindling ammunition and of Custer and of lessons unlearned. Suddenly there is the smashing report of the howitzer from the hillside far in the rear. Two shots, then nothing. It turns out that the Indians have captured it, killing a corporal, wounding two sergeants, sending two privates hotfooting away with cries that "This is another Custer massacre!"

About 150 troops are cooped up on the bluff. About 60 Nez Perce warriors surround them. That number diminishes as families gather belongings and horses and move out across the prairie. The soldiers cannot raise their heads to see this ragged exodus.

"The Indians were getting up in the trees to pick us off," wrote a Private Coon, later. "They were quite



killed in the battle, volunteer Millard F. Sherill, Cpl. Loynes and Capt. Catlin, who commanded the volunteers. Several of these photographs were made years after the battle.

successful in this as they got about seven of us, including Lieutenant English before we found the sniper. He was finally located and dropped from his perch by Sergant Abbot." English later died.

Thirst increases. Flies buzz around open wounds, dead faces, horse carcasses. Bullets snap through the underbrush. Sometimes a Nez Perce appears, shadowy, nearly naked, pausing to shoot, then vanishing. Gibbon sends a couple of men to try to reach Deer Lodge, 75 miles away, and get help. The Indians start a grass fire to flush out the whites, but a windshift snuffs it out. A warrior, Red Moccasin Tops, is slain, and at least eight other Indians try to get his prized wolfskin cape. They get it, but it costs them. Hunger drives some of the soldiers and the Colonel himself to eat part of a dead horse. Gibbon notes later that it tastes "very well."

Night falls and is lit by flashes. At about 11, two quick volleys from the Indians rip through the knoll. There is nothing more. All day the Indians have been moving away. The parting shot is from the rear guard.

Back at the visitor center drums were thumping and feathers bobbing as dancers stamped and spun, seeming still to be celebrating their triumph. For of course it was their triumph. The poor old 7th was effectively knocked out, for the time being.

Yet in the long run, the Battle of the Big Hole was the end of the road for the Nez Perce. The Crows did not take them in, and Joseph's people had no place to go except Canada. Their hegira led through five-year-old Yellowstone National Park, then northward to within less than 40 miles of the border, 1,700 miles from their homeland.

At Bear Paw Mountain, General Nelson Miles, asked by Howard to lend a hand, caught Joseph. True to the old army tradition of Indian warfare, Miles sent his cavalry on a classic charge—bugles, sabers thrust forward, the whole bit. And the weary, beaten Nez Perce warriors, what was left of them, wearing scraps of blanket and uniform to keep out the October chill, snuggled behind rocks and neatly scythed down the cavalry, hitting 53 of 115 men. The horses reared around and charged the other way. So much for the John Wayne movies.

But the Indians were finished. Speaking for most of the chiefs, Joseph made his famous statement about fighting no more, and the troopers looked at him and his ragged little band with respect and pity.

The Big Hole made that ending almost inevitable, for it showed the Indians that crossing from one kind of terrain to another, from one territory to another, from a hunting-gathering culture to a buffalo culture, was not enough to safeguard them from the army. Defeating the soldiers, again and again, was not enough. "I stand here for the President of the United States," said Howard before the war began. "There is no spirit good or bad that can hinder me." Which ultimately meant that no Indian in this country could ever again hope to live freely as part of his sacred Earth.

The Big Hole also stirred white guilt. "It is a sorry duty I am involved in to carry out the Federal Government's orders." Howard again. And his adjutant, Major E. Clay Woods, was sickened: ". . . power is not justice, force is not law!" he declared.

Howard and Miles promised Joseph that he and his people would be returned to their country. They were sincere. But the government paid no attention, and Joseph went off to Fort Leavenworth, a prisoner.

I stared at his picture on the wall—haughty, handsome, a decent, devoted man. And I studied the other decent faces, the boyish lieutenants as they appeared

in their West Point yearbooks, the volunteers, all seemingly in dark suits as befitted posing before a camera. "Why I remember him when I was a boy," murmured a tall, elderly man in a Western hat, pointing to one of those faces. He went on to tell his wife about his great uncle who "drove a wagon for the army at that time. He used to say that he was all excited about going to war until he came on an Indian campfire, still warm. He said that cooled him off."

I turned away to inspect the howitzer, salvaged, reassembled, now on display. I went out to hear the speeches from a flag-draped platform. There was a benediction, next a welcoming speech from the Park Service, pointing out that this national battlefield was now a symbol of interracial unity, that amity now flowered where blood had flowed. This was followed by a speech by a local historian—an absorbing account of the event from the military point of view, indicating that the Nez Perce had pulled off a remarkable victory after the staggering impact of that initial massacre, that they had, indeed, outgeneraled and outfought the army during most of the campaign and that Joseph had only been brought to bay because of starvation and growing weakness and despair as he raced both the army and the winter toward Canada.

Then came the speech by a descendant of Chief Looking Glass. It fell like ice water on the balmy mood of the crowd: "This battle represents in the hearts and minds of the Looking Glass one of the saddest days in the tribe's history. . . . Many of the stories told of this place are sorrowful ones. . . . One hundred years later that memory may have dimmed a little but today that memory is sharp, and tears are felt in the hearts of the Looking Glass today."

The crowd applauded as though the man had said something smooth and easy. Then the flags were marched off and the station wagons and pickups began to fill up and head off for cottages with TV antennas. My friend in the Western hat and other local whites drove off in long Detroit cars to sit on sofas and drink good Bourbon and talk about cattle and hay and mining and football.

A park ranger began picking up a few scraps of litter. Indian kids scampered between cars. Some wore blue T-shirts with "Looking Glass" on them. One college-age dancer had a suitcase with a bumper sticker pasted on it: "America—love it or give it back." He was just about the age of the warriors of 1877.

Troops attacked Nez Perce camp across the swampy, meandering Big Hole River in foreground, then were driven back to where photographer stands. Visitor center with tepee roof is on hilltop.

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In 1858 *Punch* cartoon Father Thames presents his offspring—Diphtheria, Scrofula, Cholera.

By Timothy Green

Father Thames has cleaned up his act, at long last

A river most foul has come back to life, with the birds and fish once more in residence, after $200-million revival job

The author, who lives in London not far from the reclaimed Thames, wrote about a Taiwan entomologist in November 1977 SMITHSONIAN.

Tourists strolling beside the river Thames on the broad walk by the Tower of London are likely to be discussing the Crown Jewels they have just seen, or musing historical thoughts about the unlucky princes and princesses who once stepped ashore through Traitor's Gate to a miserable fate. They also tend to focus their cameras on Tower Bridge nearby, hoping its roadway may open to let through some fine tall ship. No one pays much heed to the muddy waters of the river itself slipping by. Indeed, a few years ago people often held their noses at low tide to avoid breathing too deeply the rotten-egg stench rising from the polluted mud flats.

Today tourists may breathe easily, while fish and wildfowl—and Londoners themselves—have returned in abundance to the river that scarcely 16 years ago was little better than an open sewer. One morning recently the sightseers by the Tower had something else to train their cameras on. A snappy blue-and-white launch was busy trawling abeam of Traitor's Gate, and presently a couple of strong young men in waterproof blue coveralls hauled in a net full of flounder, mingled with a few prawns. "The catch is pretty good here all summer," said Mike Andrews, a marine biologist with the Thames Water Authority. "The river is no longer a barrier to life."

The rebirth of the tidal reaches of what rivermen call the Inner Thames, stretching for 25 miles down-

Rare catch—a salmon from the Inner Thames—is held by Chairman Peter Black of Water Authority.

Left: Near Tower Bridge, biologists haul in flounder, sprats, an eel from once-dead stream.

stream from the heart of London to Tilbury, must be chalked up as one of the more successful global battles against a decaying environment. As the editor of the British magazine *Water* wrote, "It is the first time in the world that an industrial river once so polluted as to be recognized as lifeless has been restored to something approaching a natural state."

The Thames Water Authority (TWA), which since its establishment in 1974 has presided over the river's health, is so pleased that its chairman, an engineer, boasts: "This is the cleanest metropolitan estuary in the world. We challenge anyone to disprove it."

The task of creating this new symbol of British pride has been long and costly (SMITHSONIAN, September 1970). It has taken more than 16 years and has soaked up close to $200 million in taxpayers' money and that spent by individual industries in conforming to stringent pollution-control standards. The clean-up was long overdue. If it can be said today that the Thames is one of the first estuaries in the world where pollution has been successfully contained, it should certainly be added that it was also one of the first to be ruined. The decline to disaster in the 68-mile-long tidal river (the 146 miles of freshwater stream above Teddington Weir to the source near Lechlade, Gloucestershire, have never been seriously threatened) began more than a century and a half ago with the establishment of gasworks along its banks, followed by the widespread use of the water closet in populated areas.

Before that, most of London's waste had lain around the streets or festered in some 200,000 cesspools until carted off to fertilize market gardens in the surrounding countryside. With the invention of the w.c., it was being swept down town drains and dumped, untreated, directly into the Thames. By the 1850s a fine river, which had supported a thriving commercial fishing industry, was almost dead. Cholera epidemics swept the city, and in the summer of 1856—"The Year of the Great Stink"—the stench was so appalling that sheets soaked in disinfectant had to be draped over the windows of Parliament.

Charles Dickens had summed it all up in 1851 in an imaginary journey downriver with "Father Thames," of whom he asked, " 'May I inquire what that black, sluggish stream may be which I see pouring into you from a wide, bricked archway, yonder?' 'Oh, that's one of my sewers,' replied the Father of Rivers. . . . 'But what are those smaller mouths that send forth strange party-coloured currents to mingle with your waters?' 'That one belongs to a soap-boiler . . . Those other agreeable little outlets are from gas-factories, brewhouses, shot-factories, coal-wharfs, cow-houses, tanpits, gut-spinners, fish-markets. . . .' "

Temporary relief came for the city itself with the establishment of the Metropolitan Board of Works in 1855. Its chief engineer, Joseph Bazalgette, devised

Color photographs by Terence Spencer

Sedimentation tanks at Beckton sewage works, Europe's largest and most modern.

Aerators stir oxygen into water to compensate for discharges

an ambitious scheme for crosstown sewers which discharged into the river some 15 miles farther downstream. The health hazard, however, was merely diverted, because Sir Joseph did not realize that anything dumped into a tidal river actually progresses seaward very slowly. Depending on the weather or flow of fresh water from the upper reaches, it takes 20 to 80 days for an object tossed in at London Bridge to descend just 70 miles to the North Sea.

The continuing danger was underlined by the sinking in 1878 of a pleasure boat, the *Princess Alice,* off one of the new sewage outfalls, with the loss of 640 lives. A public inquiry revealed that many of the dead had not drowned, but were poisoned by the water into which they had been tossed. The outcry over this eventually led to the building of two proper sewage works, where solid matter was settled out, and the sludge loaded into special ships for dumping out at sea. For a few years thereafter the quality of the river actually improved; whitebait came up from the sea, and such freshwater fish as dace and roach again could be found close by the Houses of Parliament.

The respite was short-lived. Increasing population and industrialization soon overstrained the facilities. By the mid-1930s, 190 sewage works alone were discharging into the Thames or its tributaries in the immediate London area. The bombing during World War II, which destroyed or damaged many sewers and works, compounded the trouble. In 1951, the nation celebrated the beginning of its postwar recovery with a Festival of Britain along the Thames, but the waters that flowed past the exhibition were, as someone later wrote, "very dead and looked and smelled that way."

"There was no oxygen in the water for nine months of the year over a 25-mile stretch," recalled Dr. Alwynne Wheeler, a biologist with the Natural History Museum of the British Museum. "I made a study of the river in 1957 and could find no living animals whatsoever from London down to Gravesend."

A strategy for salvation did not emerge, however, until 1961, when a governmental committee under Professor A. J. Sutton Pippard, which had been set up a decade earlier, finally published its report. The studies showed that 79 percent of the pollution in the tidal river came from sewage works handling both domestic and industrial waste, and a further 12 percent from industrial discharges directly into the river. These pollutants reduced the amount of dissolved oxygen in the water to nil in many places, rendering life impossible. The answer had to be massive improvement of the sewage-disposal facilities, coupled with tight controls on industrial waste. The ultimate target, the committee proposed, would be either to return the river to such a healthy state that it could eventually support salmon (a fish to which pollution is fatal), or improve the waters simply to a level where they would never again give off any offensive smells. The second option was adopted as the more realistic.

Happily, some 17 years later, that modest second goal has been exceeded. The Thames may not yet be a fine salmon river, but three salmon have been found in its inner reaches since 1974—the first spotted in these waters in more than a century (p. 103).

The best way to appreciate the regeneration is, like Dickens, to voyage on the river. Indeed, this is really the only way to get a satisfactory look, for the banks of the Thames below London Bridge are still cloaked for miles with factories, warehouses and wharves.

One summer morning I stepped aboard *Thameswater,* a spanking 45-foot launch that was commis-

that Thames Board Mills, across the river, could not eliminate.

Beckton's flow of 200 million gallons daily makes it Thames' biggest "tributary."

sioned by the water authority in 1975 as a biological research laboratory.

We embarked at Crossness, about 14 miles downstream from London Bridge, one of the most crucial reaches in the cleanup story. For Crossness, on the south bank of the river, and Beckton, a mile away on the north bank, are the two sewage works that handle more than 60 percent of London's waste. A $50-million modernization program at these two plants since the mid-1960s has made the largest single contribution to the river's transformation. Both now have vast acreages devoted to the usual gadgetry of the sewage trade —aerators, digestors and settling tanks—to treat more than half of the outpourings of Greater London, with its more than seven million people. A fleet of special ships carts away over five million tons of sludge a year and dumps it out in the North Sea, while the remaining treated effluent flows into the river. Beckton, which was fully commissioned in 1976, is not only the largest sewage works in Europe, but it is actually the most important tributary of the Thames, into which it discharges, on an average, more than 200 million gallons of treated effluent a day (above).

As *Thameswater* bore us across the river toward this torrent, Mike Andrews switched on a dissolved-oxygen meter in the laboratory to provide a constant measure of the level of oxygen in the water. "Sixty-five percent," he read off. "Very good. Salmon can run in 30 to 50 percent dissolved oxygen. And we're between the two main sewage outfalls. Fifteen years ago the oxygen reading here would have been nil." (In the summer of 1976, the oxygen levels were the highest for any summer since 1882, when records started.)

By now *Thameswater*'s coxswain, John Smith, was nosing his boat into the tumbling waters of the Beckton outfall. "Plenty of mallards right there in the effluent," he said, "and you'll often see as many as 15 herons here on the mud at low water. Fish even make their way up the effluent channels!"

The flow from the sewage works looked a good deal cleaner than the river itself, which will always appear muddy to the eye because of silt. The needle on the dissolved-oxygen meter actually flickered up to 70 percent. "We'll move upstream a couple of hundred yards and try a trawl for fish," said the skipper.

Presently we hove to hard by a silent and deserted monument of steel and concrete, which bore the sign "North Thames Gas Board, Beckton Works."

"This gasworks used to be one of the worst polluters on the river," said Andrews. "Its waste was really toxic, full of cyanides, phenols and ammonia. But it's closed down now, thanks to North Sea natural gas, and only the birds use it. It's an ideal place to check for fish."

So it proved. Ten minutes later a muddy net laden with flounder, Dover sole, sprats and prawns was pulled aboard. "The return of these migratory fish is the true sign of the river's rebirth," said Andrews, as he sorted the catch. "Ninety-five species of fish have been identified in the last decade. We've had smelt, bass, mullet, bib, or pout, sea trout and even a sea horse, along with a superabundance of shrimps and prawns and one rare Chinese mitten crab. Last month we found a 15-pound cod in the screens of the water intake at one power station, and we got 1,500 whiting there in half an hour. The fish stocks are growing every year. The river is so much cleaner that a whole cycle of life has come back. Green algae and seaweed are growing again, marine worms have recolonized the mud, so fish have plenty to feed on, and in turn the

Foreign Secretary Dr. David Owen and his wife live in big, white modernized house at left.

fish are a food source for many of the wading birds."

The benefits brought about by modernized sewage works and by shutting down toxic gas plants have been further enhanced by keeping riverside factories under an ever tighter rein. It is illegal for industry to discharge anything but uncontaminated water into the Thames. Complying with this requirement can be costly. Mobil Oil Corporation has spent $500,000 on aerator tanks to improve treatment of 1,000 gallons of refined processed water per minute at its Thames-side refinery to make certain that not a drop of oil remains.

Perhaps the most original solution to pollution control was arrived at by a local paper-recycling plant, Thames Board Mills Limited. This firm, located on the north bank of the river at Purfleet, found it could not economically bring its daily 2½ million gallons of effluent up to required levels. So, the company paid all research and development costs for two huge floating aerators which compensate for its own substandard discharge (pp. 104-105).

"It's amazing how much gadgets like these help," said the *Thameswater*'s skipper, as he took us down to have a look at the flying arms of the aerators churning the water up into a maelstrom, thus allowing it to absorb more oxygen. "You know, I've been on this river for 16 years and you wouldn't believe the change. It used to be vile—there's no other word for it. Ships' captains always complained that the brasswork on their vessels dulled over as soon as they came upriver. Nowadays the samples we take for the laboratory sometimes come up looking as pure as tap water."

The most visible testimonial is the abundance of birds. As we chugged upstream to do a spot of trawling off Tower Bridge, the launch slowed down near Greenwich and turned in toward the bank. A large flock of Mute Swans was feeding quietly in the shadow of giant cement silos (p. 108). "We'd have seen no swans

On a Regatta weekend some Morris dancers cavort before a crowd at St. Katharine's Dock, which

Enjoying their river view, the Owens find the Thames is now a pleasant river to live by.

has been renovated into busy, 240-berth yacht marina bordered by boutiques, restaurants, pubs.

here 10 to 15 years ago," Smith said, "or if we had, they'd have had to be taken out of the water and cleaned every day."

While several hundred swans and an assortment of Mallard and Shelduck are now year-round inhabitants of the inner river, the real eye-opener is the winter population. The birds, noted Dr. Jeffery Harrison, an ornithologist who has faithfully chronicled the birds' return in his book *The Thames Transformed*, are "tangible evidence of a miraculous transformation. As recently as the early 1960s, an account of the birdlife of the Inner Thames would have made depressing reading. A few paragraphs would have been enough to describe how decades of pollution have reduced the teeming wildlife of past centuries to a pitiful state of near extinction."

Today, however, Harrison rates the Thames with the Dutch polders and the marshes of southern France as winter wildfowl havens. "The return of a profusion of wildfowl and waders . . . " he stressed, "is one of a wildlife triumph against almost insuperable odds."

A testimonial from the birds

Regular bird counts initiated on the river for 25 miles below London Bridge in the 1960s spell out what has happened. During the winter of 1961-62, for example, peak counts showed only 72 Shelduck and 250 European Teal, compared with 932 Shelduck and 650 European Teal in the winter months of 1975-76. The Pintail population has risen from one bird in 1967 to more than 200 in most winters of the 1970s, while Pochard have increased from a scarce 100 a decade ago to 2,000 in some recent winters. Waders are equally abundant: visiting Ringed Plovers are up from 15 to 250 in less than ten years, the Redshank count has more than doubled, and that for Dunlin is up from 800 to 7,000. Occasional visitors have included the Canada and Brent Goose, the Shoveler, the Goldeneye (never before sighted on the Inner Thames), the European Curlew, the Ruff, and even a solitary Glossy Ibis. This winter's population, which totaled more than 10,000 wildfowl, means the Thames is classed as a refuge of international importance by the International Waterfowl Research Bureau. The summer population should be smaller, primarily because the crowded river banks offer little room for breeding.

The birds returned, quite simply, because the river was cleaner. A few years ago a perpetual thin film of detergent on the water could have upset their waterproofing, as they foraged around in the mud for the *Tubifex* worms on which many of them feed. Now, besides the worms, the flourishing fish stocks and burgeoning green algae *(Enteromorpha)* all along the banks and wharves offer an ample diet. One curious

footnote to the cleaner river, however, is a decline in the density of some species of *Tubifex,* which apparently like nothing better than brackish waters and heavy pollution. In 1975 there was a balance, with plenty of *Tubifex* still around for the birds to eat. But as the water improves annually, these particular worms cannot thrive. The *Tubifex* population was further depleted by a drought in 1976, when the poor freshwater flow led to increased salinity in the river up to London Bridge, thus killing off many worms. The birds, in turn, denied a favorite delicacy, have not been so abundant for the past two winters.

Birds and fish are not the only ones to appreciate a cleaner Thames. As Jeffery Harrison pointed out, the Thames is now a river "fit for humans to live by." Many new housing developments and pathways are being planned facing the river, and the way has been paved by none other than Britain's young Foreign Secretary, Dr. David Owen, and his American wife, Deborah, who have renovated an old riverside structure at Limehouse that gives them a fine view of the tideway (pp. 106 and 107).

The potential for riverside development and pleasure boating is tremendous. Most of London's docks have been overtaken by the container boom that has made them obsolete, and they are now closed. For the moment they are in a curious limbo land, waiting while politicians and planners argue what can best be done. Warehouses lie derelict and docks deserted, except for the ducks that have found a new quiet home. The way ahead, however, has been shown by the renovation of St. Katharine's Dock, in the shadow of Tower Bridge, into a 240-berth yacht marina surrounded by luxury apartments, boutiques, restaurants and rambling pubs, many built out of ancient warehouses (pp. 106-107). Such a spontaneous revival along the river would have seemed inconceivable a decade ago. No one then had any desire to keep his boat in or sip beer by such a smelly moorage. But today, "We're thriving," the harbormaster said, as he checked in a Dutch yacht. "We're getting boats from all over Europe, and everyone raves about being able to tie up in the heart of the city."

No one pretends that the job on the Thames is finished; indeed, some British ecologists complain that, in view of other pollution problems, the Thames is only a showpiece. The TWA hopes, however, that once it has completed the modernization of another major sewage works downstream in 1980, the task will be chiefly ongoing maintenance. Indeed, the only thing that really prevents the Thames from becoming again the fine salmon river it was two centuries ago are the modern locks and weirs of the freshwater stream above London, an obstacle en route to the salmon's faraway spawning grounds.

Mute Swans, long absent from Thames, search for grain in waters off a wharf near Greenwich.

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IBM Reports

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There are hundreds of companies in the information technology industry, and they are constantly developing new and better products—driving down the cost of using information technology at a startling rate. For example, just 10 years ago, it cost $25 per month to store a million characters of information in an advanced IBM direct access storage system. Today it costs 50 cents.

It is this kind of progress that has made it practical for many more fire departments, police departments, hospitals and other organizations to take advantage of information technology and put it to use in new and caring ways.

In its research, and in the stream of products that flows from that research, IBM is searching for—and finding—still better ways to help put information to work for people.

IBM

Victor ad of 1913 brings performers and composers into living room. Among them: Mischa Elman on the Victrola; Paderewski and de Pachmann on piano; Caruso in center of rug; Nora Bayes and kilted Harry Lauder in right foreground; J. S. Bach, Beethoven and Wagner seated in row directly above them; Victor Herbert, with cello, in the rear; beside him in the armchair, bandmaster Arthur Pryor; and two vaudevillian comics on the fur rug.

By Harold C. Schonberg

Edison started the big noise a century ago

More than 73 million phonographs in use in America trace ancestry to a wizard's foil-wrapped cylinder

Thomas Alva Edison invented the phonograph. We all know that. But a couple of Frenchmen, including Charles Cros, might have disagreed.

Every age has its fashionable area of research. Today it is genetics. In the middle part of the 19th century it was, for many scientists, the possibility of reproducing sound. In 1857, a French amateur scientist, Edouard-Léon Scott de Martinville, constructed a machine to measure the amplitude of sound waves. He called it the "phonautograph."

Then, early in 1877 Charles Cros, in Paris, wrote a paper (published much later in the year) which set forth the basic theory of the phonograph. Cros never attempted a working model, and Edison, who was not aware of the Cros paper, was the first to build a machine that worked.

Edison, also early in 1877, had invented a carbon transmitter for the newfangled telephone, introduced by Alexander Graham Bell the previous year. That set Edison off on an investigation of sound. On July 18 he made an entry in his journal: "Just tried experiment with diaphragm having an embossing point and held against paraffin paper moving rapidly. The speaking vibrations are in-

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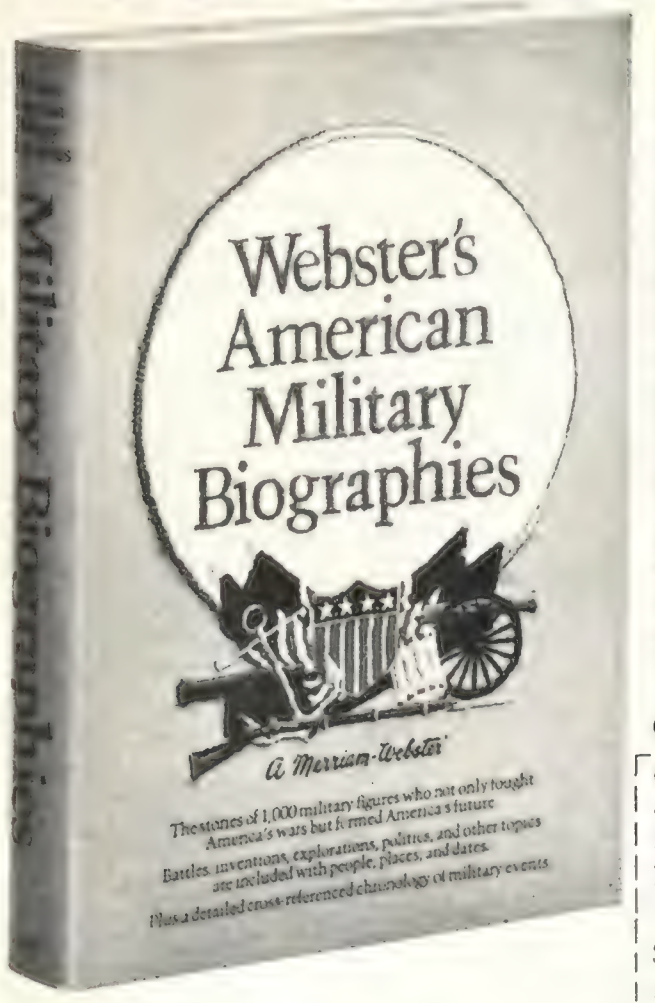
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Edison at 31 displays model of his improved hand-cranked device.

dented nicely, and there's no doubt that I shall be able to store up and reproduce automatically at any future time the human voice perfectly."

The exact date of Edison's invention is unknown; it was probably in November 1877 (he filed the patent application on December 24, shortly before his 31st birthday). Whatever the date, Edison supplied one of his workmen, a mechanic named John Kruesi, with a working diagram. Kruesi constructed the device and brought it to Edison, who cranked the handle and recited the first stanza of "Mary Had a Little Lamb." The thing worked. A startled Edison heard his voice recognizably played back. In later years Edison said: "I was never so taken aback in my life—I was always afraid of things that worked the first time."

Edison adopted the term "phonograph" for his new talking machine. In Greek, "phone" means "sound" or "voice," "gramma" a thing drawn or written, "graphein" is the verb "to write," "auto" means "self." Thus phonograph, gramophone, graphophone, phonogram, phonautograph. Today only two of these words have survived: phonograph in the United States and gramophone in England.

The original Edison device had a grooved cylinder around which tinfoil

Mr. Schonberg is the senior music critic of The New York Times.

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His Master's Voice by Francis Barraud stars Nipper, the London artist's fox terrier. Painting and dog earned fame as trademark.

was wrapped to catch the vibrations of the sound source; a stylus, or needle, indented those vibrations. There was no practical way of making a duplicate. That came later. While Edison turned his attention to the incandescent light bulb, others started perfecting the phonograph. About ten years after Edison had recited his nursery rhyme, Alexander Graham Bell, his cousin Chichester A. Bell and a Boston inventor named Charles Sumner Tainter worked out a wax-coated cylinder that made recordings of which, under ideal conditions, one or two copies could be made. Just about that time, too, Edison reentered the record business, forming his own company.

Edison, partly deaf, thought little of recording music. He was interested in dictation, recordings for the blind, oral histories, the preservation of languages, the teaching of elocution, clocks that could tell time aloud—in short, his invention's business and educational potential. All of these ideas and even more have been fulfilled, one way or another, but above all the phonograph has come to mean music and entertainment.

The first important musician to record was the 12-year-old prodigy Josef Hofmann, who visited Edison in 1888 and made some cylinders for him. Hofmann, who developed into one of the greatest pianists in history, claimed to have had those cylinders for many years, but today they are lost.

To publicize his invention, Edison sent an agent, Theo Wangemann, to Europe. Wangemann visited many notables and captured no less than Johannes Brahms in Vienna. The great composer, in a high, squeaky voice, paid his respects to Edison and played a few measures of his *Hungarian Dance No. 1.* You can actually hear that cylinder; recently it was transferred to an LP disc by the International Piano Archives at the University of Maryland. But the surface noise is so high that very little really comes through.

Edison kept in his Menlo Park, New Jersey, laboratory many cylinders that his agent had recorded, or that had been sent to him: the voices of Florence Nightingale and Bismarck, the notes of the bugler who sounded the charge of the Light Brigade, Tennyson reciting his poems. That is almost as far back as the phonograph can take us, for Tennyson was born in 1809. There is in England a cylinder with the voice of a man born in the 18th century. Nobody important. The person in charge of recordings simply wanted to preserve a voice that had first squealed in the previous century.

The things that have been lost! There are rumors of cylinders by Liszt and his

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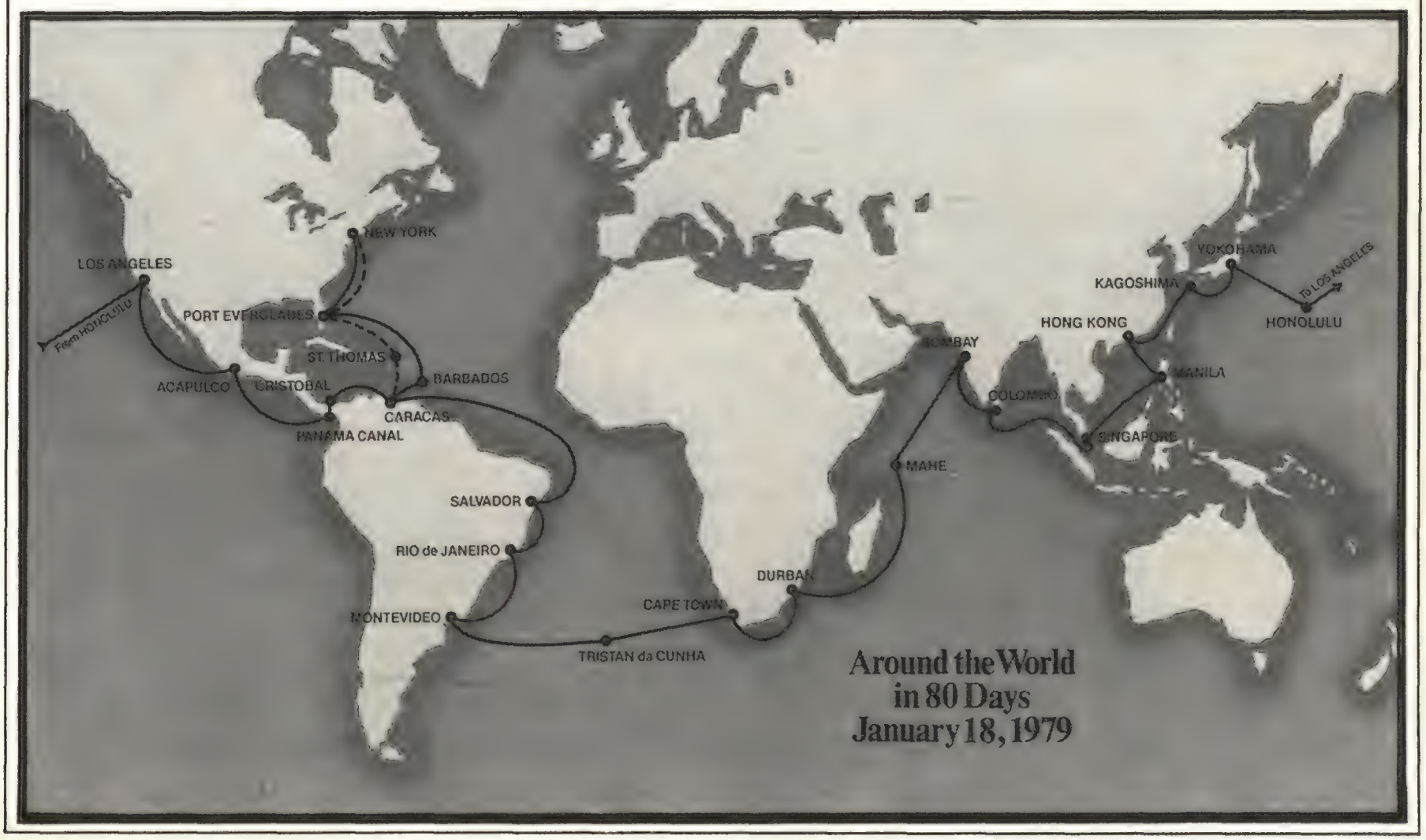

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Dame Nellie Melba braves a Paris recording studio around 1910, when sound-gathering techniques were growing in sophistication.

only rival, Anton Rubinstein. Two Edison machines were recording in Carnegie Hall in 1891—the year it opened—when Hans von Bülow conducted Beethoven's *Eroica*. Two machines in different parts of the hall—that would make it stereo! Where are those cylinders? Dashing Lieutenant Gianni Bettini recorded many great singers in the 1890s. Those cylinders have vanished, too, except for a few, recently discovered and virtually unplayable, of minor artists.

From 1901 to 1903 Lionel Mapleson, librarian at the Metropolitan Opera Company, recorded parts of operas using an Edison machine placed first in the prompter's box and later—owing to the singing ladies' distress—up in the catwalk. Eames, Melba, Calvé, Nordica, Scotti—those great, mind-shattering singers! Some Mapleson cylinders were transferred to the 78 rpm format, and later to LP, by a collector named William H. Seltsam, but Seltsam's discs are hard to come by today. Mapleson cylinders are impossible to find, except in the Rodgers and Hammerstein Archives of Recorded Sound of the New York Public Library at Lincoln Center. Of the 117 cylinders there, about 50 have never been identified. The cylinders were in terrible shape, but through the noise does come some paralyzingly exciting singing. There are even a few notes sung by the legendary Jean de Reszke, the greatest tenor before Caruso.

The next significant step in the development of the phonograph came with Emile Berliner's invention, in 1887, of the flat disc which could be stamped out in large numbers. Columbia and Victor entered the field, and by the turn of the century European labels were making their appearance: the Gramophone Company in England, Pathé in France, Fonotipia in Italy. All concentrated on flat discs. Edison alone stubbornly continued making cylinders, but finally he had to surrender, and in 1913 brought out what he called the Edison Diamond Disc Phonograph. He stayed in business for another 16 years, closing down in 1929.

In the earliest days manufacturers were not much concerned with serious music. Purchasers had their choice of cornet solos, band music (especially under the baton of one John Philip Sousa), whistlers, balladeers, humorists, monologists. Shortly after 1900, however, there was a deluge of important musicians—singers, mostly—eager to make records. The phenomenal voice of Enrico Caruso really put records on the map (p. 118). The public could not get enough of him after his first records appeared in 1902. He sold countless discs (for which he was paid countless dollars). Following his example, other great singers of the period began to make recordings.

It so happened that the early phonograph, in which the singer sang directly

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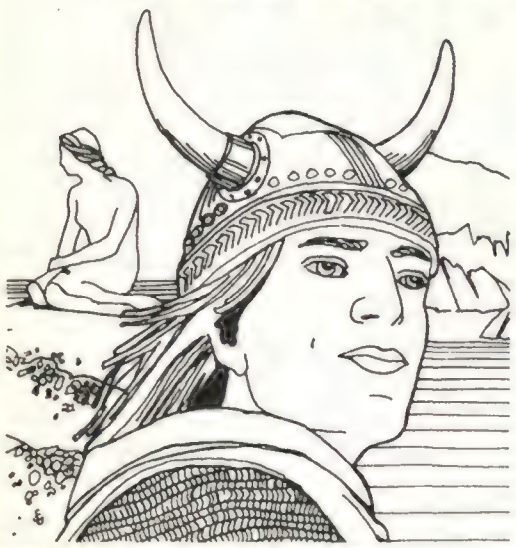

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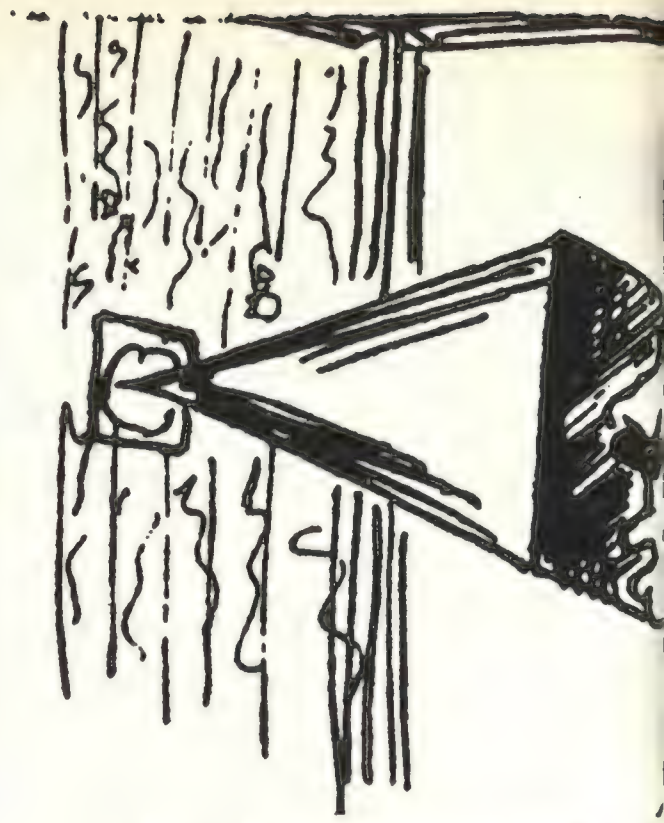

Enrico Caruso caricatured himself making a recording. He was one

into a recording horn, was kind to the human voice. There are those stubborn old-timers who maintain that no vocal records are better than the ones made in the first decade of the 20th century. Today we have a very good idea of what Caruso, Melba (p. 116), Sembrich, Journet, Gadski, Destinn, Farrar, McCormack and other immortals really sounded like.

It was harder to reproduce musical instruments with primitive equipment, yet a shadow is better than nothing, and often an early piano recording (p. 120) in mint condition can be remarkably lifelike. There was much more in those grooves than the makers realized. Delicately calibrated modern equipment can make even the oldest, scratchiest record reveal secrets. Today we can enjoy and study the work of such pianists as Hofmann, Raoul Pugno, Vladimir de Pachmann, Paderewski and others, all of whom were on records before 1910. There were great violinists, too—Pablo de Sarasate, Jan Kubelik, Joseph Joachim, friend of Brahms and violinist nonpareil.

Orchestra recordings posed a real problem for the horn. In days of single-sided records running some four and a half minutes, it was a problem to record any long piece. Most opera arias and songs could fit the format of the single-sided disc. So could many piano and violin masterpieces. But what to do with a full-scale symphony?

Around 1910 such conductors as Thomas Beecham and Felix Weingartner were

of the first opera stars to be paid royalties for their recordings.

making records of short orchestral pieces. A 1914 Columbia disc, ostensibly of Tchaikovsky's *Pathétique* Symphony, gives only a few measures midway in the first movement. But in that same year a famous conductor was represented on records by a full symphony. Arthur Nikisch, the Toscanini of his day, did the Beethoven Fifth in Germany, using a greatly reduced orchestra. There were even attempts at complete opera recordings before 1910. In classical music, incidentally, the European catalogs were much richer than ours.

Electrical recording in 1925 supplied the next giant step. The Bell Telephone Laboratories had worked out the process, and all who heard it immediately realized that the days of the old acoustic record were over. With electrical recordings, the frequency range was greatly extended, there was a real bass sound, there was a kind of presence and color hitherto unknown. Everybody rushed to scrap old equipment and join the parade. Victor was first in the field, with a disc of a production of the University of Pennsylvania's Mask and Wig Club, but the record that swept the country was Columbia's *Adeste Fideles*, with a huge chorus (4,850 voices, according to the record company's computation).

Now for the first time the music-loving public had access to album sets of great masterpieces in their entirety. Victor led off with Stokowski and the Philadelphia Orchestra in the Dvořák "New World" Symphony. There was a deluge: Artur

Do you get input when Tony Randall gets information?

Input is what goes into a data-processing system. Tony Randall, a new member of The American Heritage Dictionary Usage Panel, does not consider himself a computer. Like most of the current members, he prefers getting *facts* or *information.* Led by Edwin Newman, the panel is polled regularly for up-to-date advice on using words effectively. This exclusive feature, along with 155,000 entries, 4,000 illustrations, and thousands of new words, helps make The American Heritage Dictionary the complete contemporary dictionary. From $9.95

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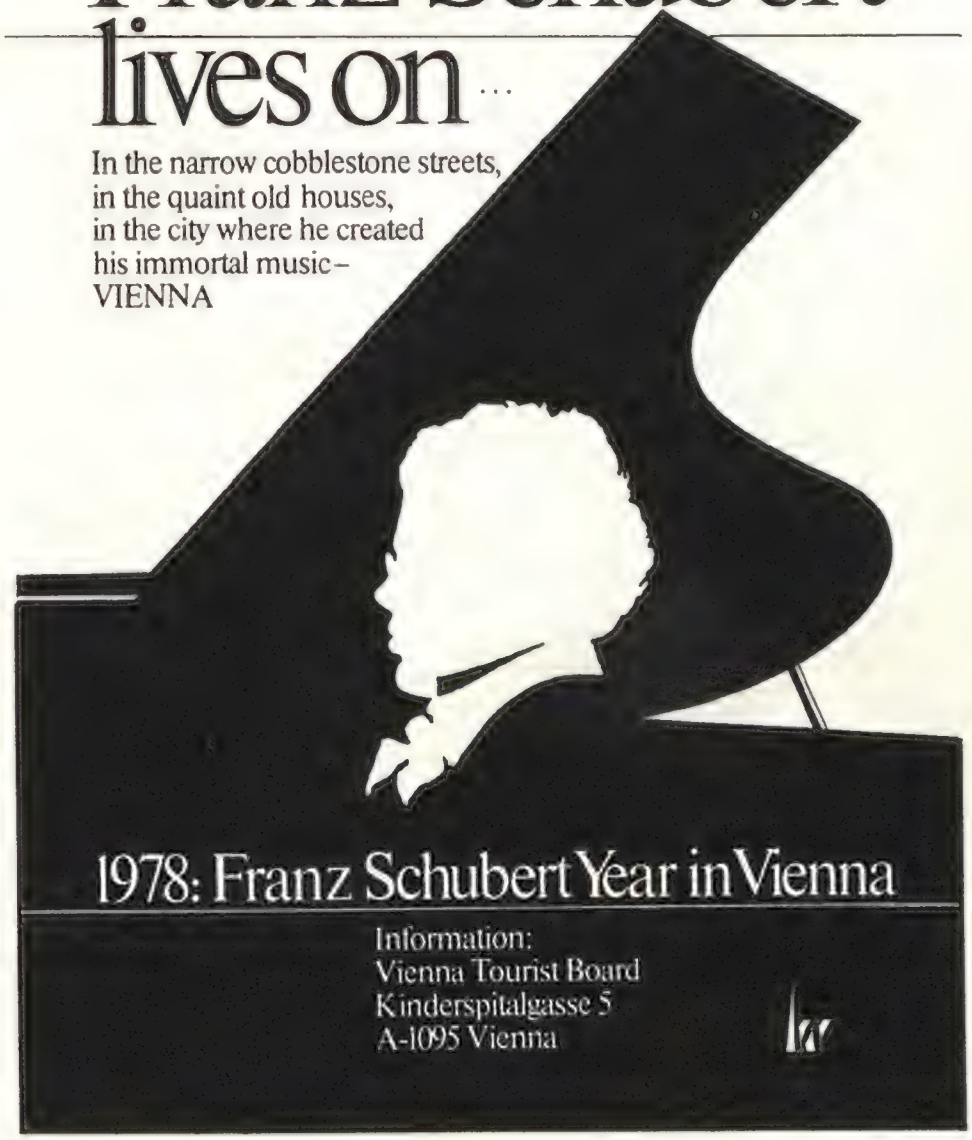

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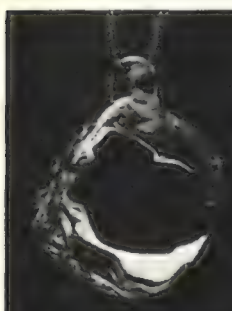

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Recording piano music in the 1890s was not so dependable because Schnabel in the complete piano sonatas of Beethoven, in a series of Mozart concertos, in the great Schubert sonatas; Mozart operas from the Glyndebourne Festival in England; Chopin from Artur Rubinstein; all 16 Beethoven quartets from the Lener Quartet; complete operas; Bach on the harpsichord from Wanda Landowska. Horowitz, Heifetz, Toscanini, Koussevitzky, Flagstad, Melchior—all the great names enlivened the electrical recording. Those were heady days for the collector of serious music.

On the lighter side, jazz and pop musicians flourished. Classical music has never made much money for the big record companies. The biggest sellers have always been the big bands and entertainers —Bing Crosby, Benny Goodman, Duke Ellington, Louis Armstrong, Frank Sinatra—and so to Elvis Presley, the Beatles and their equivalents of our decade.

The third Golden Age arrived shortly after World War II. The wire recorder, invented in 1898, finally came into use; meantime, Germany perfected the magnetic tape. That, plus the introduction of the long-playing record by Columbia in the spring of 1948 (p. 124), started a revolution. Today we take the LP disc for granted and have forgotten those old 78 rpm albums, where a disc

of limited sensitivity of equipment. Band music came across much better.

had to be changed every four minutes or so. Now a whole symphony could be recorded on a single side of a record. An entire opera could be put on five records (as against some 25 previously). The new vinyl records, too, sounded clearer and much more brilliant.

Magnetic tape made recording much easier. Instead of recording in "takes" of four-plus minutes, musicians could sweep straight through a composition. They could also correct wrong notes, cutting offenders out and splicing corrections in. The new technique led to performances of a kind never to be found in concert halls and opera houses. Engineers could boost a small voice to make it sound like Chaliapin's or Caruso's.

The story was told of the pianist engaged to record Chopin, who made a mess of things. But each time he fell on his face, the engineers would come running out: "Don't worry, we can fix it." After hundreds of splices, a composite first movement was played, and the pianist leaned back and enjoyed it. "Not bad," he said.

"No," said the conductor. "But don't you wish you could play like that?"

One philosophy of recording, voiced by John Culshaw, a producer for Decca in London, maintained that this was an art

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form in itself—that every advantage should be taken of the new technology. When recording Wagner's *Das Rheingold* in 1958, Culshaw talked the conductor—Georg Solti—into improving the composer's scoring. At the moment when Donner, god of thunder, brings down his hammer, Culshaw had the percussionist hit a length of steel railway track with a heavy sledge. It is a spectacular effect. But it also makes live opera sound dull. Is this a service to the composer? The argument between purists and technologists continues to this day.

Whereas in prewar days American recordings had been dominated by Victor and Columbia, the early days of LP saw hundreds of entrants into the field. It was easy. One went to Europe, purchased a tape of a performance from a small radio station in Germany or Italy, returned home and issued a new recording. For the collector of classical music it was Nirvana. The smaller companies—and at one point there were nearly 2,000 in the United States alone—let the big boys record the standard repertory and the expensive operas with big-name casts. What they did was bring out perfectly acceptable performances of things that nobody except a few experts had ever heard—things that music lovers were desperately yearning to hear.

These small companies, headed by Vox and Westminster, were largely responsible for the baroque revival. Many were specialty companies. The Haydn Society dedicated itself to bringing out all of the Haydn symphonies, chamber music and

Marie Rôze, a French soprano, warbles into early Edison cylinder.

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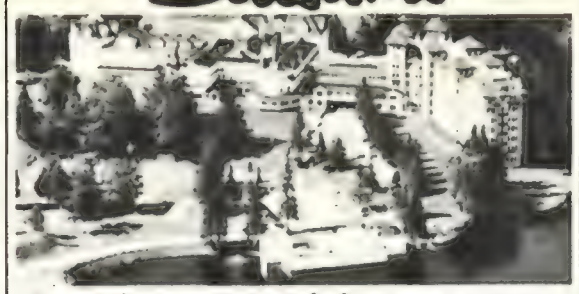

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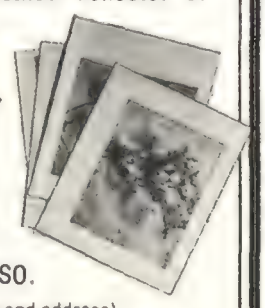

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Stack of old discs equals handful of LPs (top) held by late Peter Goldmark.

choral works. Dial concentrated on contemporary music, of which there was precious little in the catalogs. Folkways went in for, yes, folk music. Caedmon concentrated on the spoken word. There were companies specializing in jazz, in repressings of singers of the past, in pre-Bach music. Deutsche Grammophon started an Archive Series of impeccably prepared early music.

The repertory on records suddenly expanded beyond belief. Big European companies invaded the American market. The purchaser could now stand bemused before 20 listings of the Schubert "Unfinished" or Tchaikovsky's B-flat minor piano concerto. London Records started specializing in opera sung by the world's greatest artists. Cetra-Soria started bringing out virtually unknown operas by Rossini, Donizetti, Bellini, Verdi. A mania for complete editions started: the complete symphonies of Mozart (41 of those) and Haydn (104); the complete chamber music of Beethoven, Mozart, Dvořák, Brahms; the complete piano music of Schubert, of Ravel, of Debussy.

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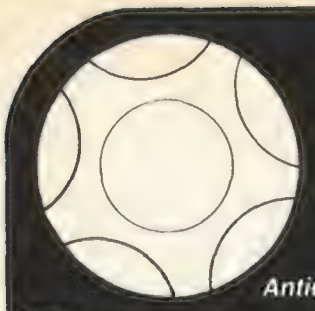

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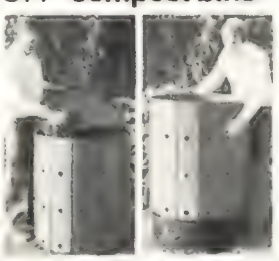

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So did high-fidelity equipment (below). In the old days one went out and bought a phonograph, with all components housed in a piece of furniture. But now! No hi-fi buff would think of getting anything but component parts. One read technical reports, shopped around for amplifiers, speakers, turntables, cartridges. Prewar phonographs were seldom able to handle more than 12 watts. Now we gloried in 100-watt amplifiers; speakers that could reproduce frequencies above the capabilities of most human ears; pickups with diamond styluses that could track at less than one gram of pressure.

Then came stereo. Components had to be doubled: two speakers, two amplifiers, a new kind of cartridge. It was another revolution, and for several years hi-fi buffs played with new toys. What a thrill to get a demonstration record and hear a Ping-Pong game: click in the left speaker, clack in the right speaker, heads swiveling left and right to follow the sound. Or listen to a train come through the left speaker,

Hi-fi for everyone—including the family dog—became feasible in the 1950s

pass through the room and disappear into the right. There was a lot of gimmickry before the record manufacturers settled down, but stereo at its best did create a spatial illusion, especially effective in opera.

Not content with stereo, manufacturers tried quadraphony a few years ago. But four speakers in a room is a bit much. The big thing these days is the stereo cassette—with enough fidelity to satisfy any but the most demanding ear.

The future? Video discs are on the horizon, recording sight as well as sound. There are periodic reports of a breakthrough in speaker design involving speakers with no mass. Instead of voice coils and cones, there will be only a column of vibrating air. There is talk about records in which laser beams will scan the grooves. Each record would have more than 20 *hours* of material on one side of a 12-inch disc. Imagine! The complete *Ring* cycle of Wagner, all four operas, on one side of a record.

All that will come. Bits of knowledge are constantly being added to other bits. Then somebody puts it all together: Bang! Another breakthrough! But the original breakthrough came from Thomas Alva Edison a little over 100 years ago. One idea, one spark of intuition, a dash of serendipity, and look at—or, even better, just listen to—what has happened!

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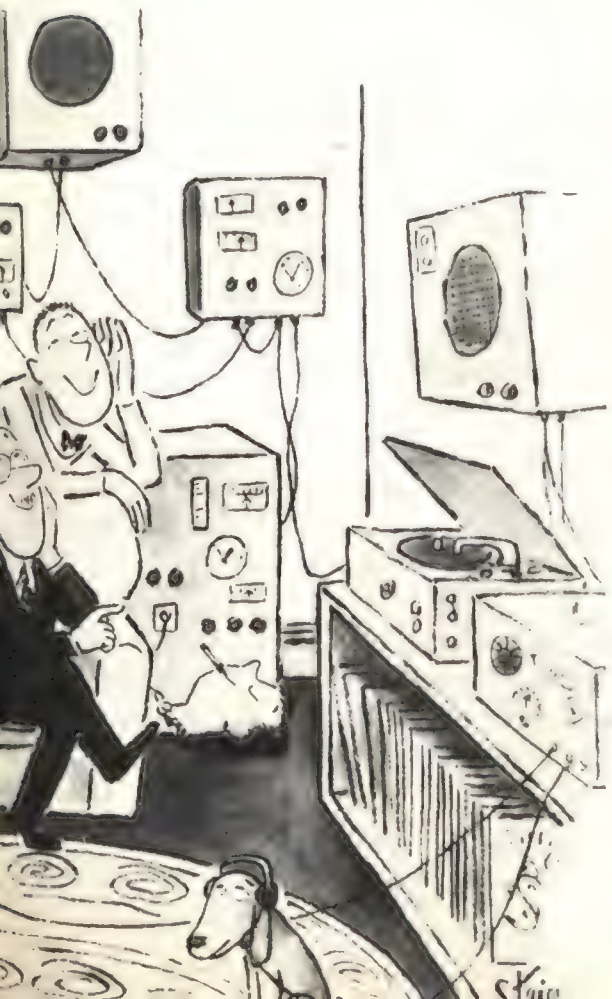

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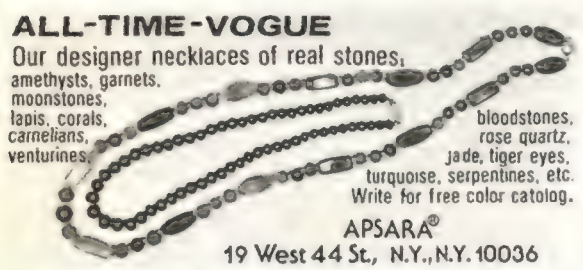

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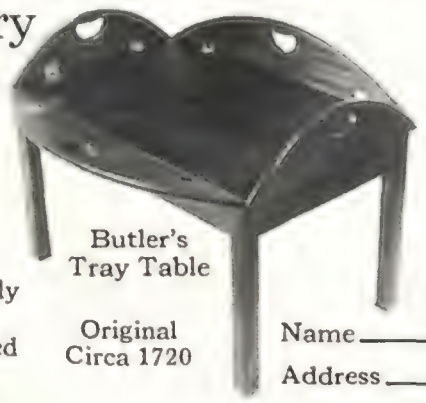

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Additional reading

SETI (p. 38)

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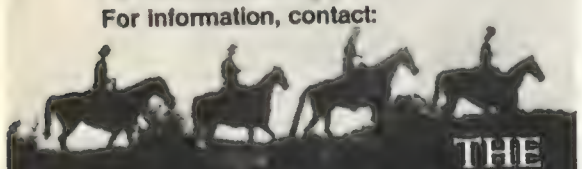

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Book reviews

Mark Twain in the Movies, A Meditation with Pictures
John Seelye
(Viking, $12.95)

In the declining years of his life, Mark Twain the author became Mark Twain the relentless self-promoter. Not only did he not mind being photographed, he positively insisted on it, until the classic image of him, jaunty in his white suit, hair ever-tousled and cigar ever-present, became the most widely recognized of any American author up to then. And more than just being well-known, Twain succeeded in being well-liked as well. "The average American loves his family," Thomas Alva Edison once remarked. "If he has any love left over for some other person, he generally selects Mark Twain."

Yet the other side of this public sainthood, also explored in *Mark Twain: God's Fool* by Hamlin Hill, was quite as somber as Twain's suits were light. The other Twain produced, in his rambling *Autobiography,* in the unexpurgated *The Mysterious Stranger* and in his suppressed erotica, some very dark, very nasty and pessimistic work indeed. In this sense, writes John Seelye, Twain was "the Moby Dick of American letters, his very whiteness connoting at the last a horrific void." A professor of American literature with a long-standing interest in Twain, Seelye has attempted in his little book to "delineate the shadow behind the gleaming white silhouette," to explore a man infinitely more complex than his contemporaries ever imagined.

Both fortunately and unfortunately, and perhaps in deference to his subject, it is an odd, quirky book Seelye has written, difficult to get a handle on, as often exasperating as it is intriguing. Even the format is offbeat: the words and pictures gaily intermix on the pages, and a delightful flip-book of Twain's appearance in an early newsreel is included as an extra bonus.

Yet that newsreel is only passingly referred to in the text. For that matter, no other flesh-and-blood film is noted at all. The movies mentioned in the title are not to be taken literally but rather as metaphorical constructs, Seelye's way of categorizing the various conceits he has

Mark Twain, "an old rascal cut loose at last and roaring at the joke."

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developed about the man who, he writes, "contains more pairs than a chess set or a shoe store."

So instead of movies, Seelye gives us many of those still photographs, which he invites us to look at with an eye toward understanding the man who posed for them. We see Twain with the troops of adolescent girls he delighted in having with him; we see him in the solitary splendor of the stiff and one-dimensional poses arranged by his idolatrous biographer, Albert Bigelow Paine; we even see, on the very last page, a charming, raffish photo (p. 130) of a very human-looking Twain, "an old rascal . . . ."

If each photograph here has been carefully chosen for effect, so has each and every word of Seelye's text. This is not a straightforward book but rather, as the subtitle says, a meditation on Twain, a series of complex, artful ruminations based both on the photographs and on years of thought, study and experience. If this makes the author's insights rich, it also makes them a bit difficult to follow for those going in without a rudimentary knowledge of Twain and his persona.

Adding to the problem is Seelye's positive addiction to word games and witty epigrams, his not being able to let so much as a page go by without slipping in phrases like "vestigial virgin," "keeper of the fame," "funding father" and so on, phrases OK by themselves but cloying in profusion. And as the book relentlessly backs away from drawing any conclusions—"these matters remain a mystery," Seelye writes at one point, "to which the photographic and written records provide no key"—it begins to seem as though the whole enterprise was begun simply as an excuse for some fancy word play. A sometimes confusing, though fascinating, book about a man who fits the same bill—but exactly.

—Kenneth Turan
Cultural critic, *The Washington Post*

Rembrandt's House
Anthony Bailey
(Houghton Mifflin, $13.95)

When I was a child in the Netherlands, we were taken on school trips to Rembrandt's house in Amsterdam, the way American children visit the White House, Mount Vernon or the Empire State Building. As youngsters we enjoyed the bus ride; as we grew older we started to giggle at the prostitutes in the windows in the neighborhood nearby; later still we sadly looked for the Jewish faces that used to be there and are no more.

But always there was the house, and such contacts gave us a very personal sense of the past. It was a personal relationship with the past, too, that Anthony Bailey sought when he decided to give in to a decades-long obsession and write a book about Rembrandt. Wanting to stay near Rembrandt's old haunts, he took a room in a house that sounds like something out of a De Hooch painting. By night he could hear the noise of bars and burlesque houses, by day he stalked his subject.

Bailey, a British novelist and writer on such subjects as urbanization, yachting and sailing intracoastal waterways, published *The Light in Holland* in 1970. In that book he looked at the country and its crowdedness as possible harbingers of other Western societies 50 years hence; *Rembrandt's House* is his effort to reconstruct Dutch civilization 300 years ago.

The "remarkable continuity of domestic things," so dear to Rembrandt and so typical of the Dutch in general, struck him as a means of understanding the painter and his position in 17th-century Holland. Rembrandt's impoverishment becomes our enrichment, for Bailey uses the inventory from the 1656 "insolvency" proceedings against him to find out how he lived and with what objects.

As an artist Rembrandt was also a collector, an almost compulsive accumulator of beautiful and costly objects who turned his home into a private museum. A generous and resourceful teacher, he attracted more students to his house than any other painter of the time. His role as husband and lover of women brought him both happiness and trials, leaving us with many images of his emotions, while his reverence for Biblical themes created pictures in which "the divine could be human, humanity divine."

Among his neighbors, patrons and friends he counted great doctors (such as Tulp) and radical printers, gentle Mennonites and strict Calvinists, scientists, and many of the learned Jews who came to Holland for the refuge it offered exiles from all over Europe. The Dutch themselves, as Bailey points out, traveled away from home during this great age of discovery, or explored new worlds by peering through the lens of the first microscope.

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Rembrandt felt the need to draw everything, even his wife Saskia dying, even a clump of weeds. Bailey feels the need to record everything, and his prose bursts almost to overflowing with facts and allusions, numerical figures as well as human ones. He cannot mention the past without the present, and vice versa, and although this is often distracting, it brings history very much alive.

However, by saying "perhaps" about practically everything, Bailey appears too tentative. He stops at Rembrandt's house, without getting inside Rembrandt himself. The movement is from outwards in, as though passing through the concentric circles that shape a map of Amsterdam. Bailey (and his numerous sources) tackles such diverse subjects as Dutch politics, culture, medicine, religion, architecture and city planning in the 17th century, and this makes his book highly valuable. There is little new material in all of this, except for the way Bailey "reads" certain works by Rembrandt (reproduced throughout) and integrates them into his story. His frequent references to etchings and drawings, especially, help establish an intimacy with small and personal things. Bailey identifies an appreciation for littleness with Dutch realism, with a peculiar intensity of vision. His Rembrandt, possessed of this kind of vision, was also a visionary. Anthony Bailey is a worthy interpreter of what he saw.

—Celia Betsky
Free-lance critic, Smithsonian Fellow

Lying: Moral Choice in Public and Private Life
Sissela Bok
(Pantheon Books, $10.95)

If you think human nature hasn't changed in the past few centuries, listen to this: no referees were needed to oversee medieval sporting events. Think of it. Back then, in that great warm-up period (which eventually led to the Super Bowl), people could be trusted. No penalty flags, no controversy and no trying to get away with as much as possible.

No more. We live in a world gone mad with lying in all its forms: excuses, justifications, official explanations, outright whoppers. Everyone does it. Governments do it, institutions do it and—sad to say—*we* do it. Pinocchio lives!

Aware of this depressing continuity between private and public disregard for a matter as basic to human survival as truth, Sissela Bok rolled up her sleeves and went to work.

Bok teaches medical ethics and decision making at the Harvard Medical School. Her involvement with doctors, placebos and the uncertain world of medical diagnosis prompted a closer look at the philosophical attitudes that make the "Big Lie" possible.

She begins by tracing the decline and fall of our resistance to the lie. For St. Augustine, all lies were a rejection of truth, and thus sinful. Eight centuries later, St. Thomas Aquinas, the great list maker, subdivided all lies into three types: jocose lies (OK), benevolent lies (OK) and malicious lies (never). By the peak of the Renaissance, Sir Francis Bacon was genuinely puzzled. Said he:

> Doth any Man doubt, that if there were taken out of Men's minds vain opinions, flattering hopes, false valuations, imaginations as one would, and the like; but it would leave the minds of a number of Men poor shrunken things; full of melancholy, and indisposition, and unpleasing to themselves?

Part of the problem for Bacon was the virtual impossibility of knowing exactly whose truth was the whole truth.

Today, there is so much uncertainty connected with modern medicine that both the prescribing of placebos for the well and the encouragement of false hopes in patients terminally ill with cancer seem justified on humane grounds. But who can say whether we have, or don't have, some inner need to know we're in mortal battle with an infection? Perhaps our leukocytes need a psychic bugle call to fight off the invaders. And surely the patient who is taught to depend on placebos loses some of his dignity and freedom of choice.

Therein lies the real issue connected with lying: freedom. All liars exercise a form of control over those from whom they withhold the truth. Thus they limit others' choice of action or response.

This is exactly the aspect of lying that appealed to thinkers like Machiavelli and Nietzsche, who were only too quick to answer the Baconian question like this: it doesn't matter what the absolute truth is; truth is simply an *ignis fatuus*, to be used as a tool for personal advancement.

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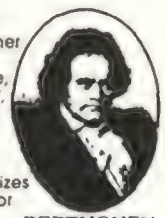

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to bigger ones, by corroding our natural resistance to saying what we know to be wrong. They also lessen our self-respect.

For Sissela Bok, the solution lies within all of us. We need to look hard for truthful alternatives to the white lies to which we are all prone. Although silence and discretion will still have a part to play, we should be careful to note whether they are being used to protect others or control them. A society that won't take the time to discipline itself like this deserves what it gets in the way of morality. How can we expect politicians and annual reports (and book reviews) to level with us, if our doctors, families and friends won't? No lie.

—Michael Olmert
Annapolis-based writer and critic

A Gift to the Street
Carol Olwell, Judith Lynch Waldhorn
(Antelope Island Press, $12.95)

The architectural label "Victorian" can conjure up images as diverse as a Gothic Revival church in New York or an early Frank Lloyd Wright "prairie style" house in Kankakee, Illinois. No fewer than 29 architectural styles have been cataloged by Marcus Whiffen as having made their appearance in the United States during Victoria's reign. *A Gift to the Street* is not so ambitious as that. Its focus is on wooden houses built in San Francisco between 1870 and 1906, the year of the great earthquake and fire.

The superb photographs by Carol Olwell immediately qualify this as an excellent coffee-table book. It is, however, much more than just a picture book. The organization of the 301 photographs is in itself instructive; the table of contents reads like a late 19th-century builder's catalog. Doorways, windows, towers, stained glass, faces, sunbursts and many other features are explored chronologically as they became popular component parts of the Victorian home-builders' vocabulary. Photographs of complete facades are interspersed with telephoto views of decorative details. The brief accompanying commentary by Judith Waldhorn sharpens perception and heightens curiosity. As she says, "Learning to look is a pleasure; the buildings will embrace your eyes."

During the second half of the 19th century, the United States witnessed a proliferation of wealth, machines, architects, builders and developers. The architectural profession was recognized; in 1868, the first major architectural school opened at MIT, and a stream of architectural journals began to circulate. These publications traversed the country, spreading news of the latest fashions in home building and advertising the latest products necessary to accomplish the construction of a thoroughly up-to-date house. Pattern books featuring elevations and floor plans and including suggested paint colors and decorative trims were also widely circulated by the burgeoning mail-order architectural establishments. A prospective homeowner could select a model from a "catalogue" and order by mail the architectural drawings with specifications ready for the builder to commence work.

Judith Waldron imparts an abundance of information about this period of intense building activity without dwelling excessively on scholarly distinctions which the layman might find tedious.

One final satisfying feature of this book is the index of street addresses provided for each photograph.

—Kathleen Sinclair Wood
Lecturer on American art and architecture, Lewis and Clark College and the Smithsonian Institution

In San Francisco, 939-41 Yale Street.

THERE ARE ANSWERS

Energy shortages don't have to become a way of life.

Gas lines, brownouts, curtailed power supplies. The warnings continue to mount, signaling that our nation's energy problem is today's, not tomorrow's.

Tough and realistic decisions are demanded. Now.

First, we've got to make a strong determination to develop and fully utilize every feasible energy source—whether it's coal, nuclear, natural gas, oil, water power, or likely alternatives such as solar, geothermal, and wind. We need them all and we must use them wisely.

But despite our best efforts at conservation and increasing fuel supplies, we may still face an energy gap of two or more decades.

One way to avoid it is by recognizing the enormous potential of nuclear power.

A third of a century ago, nuclear energy was seen as the wave of the future, promising great benefits to humankind.

That's still its promise.

This past winter, when coal was hard to burn or hard to get, it was nuclear power that kept factories and vital services operating in community after community.

Nuclear power meets the tests of economy and abundance. With aggressive national effort, safe reprocessing and waste disposal techniques can be developed. Moreover, our reserves of nuclear fuel if used efficiently in breeder reactors would equal many times the combined oil resources of all OPEC nations. In sum, this means savings of billions of dollars for consumers.

Energy shortages don't have to be a way of life.

We have the know-how and the resources to prevent them.

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Smithsonian highlights

May events

Sun Day, May 3
Festivities are planned for all day on the Mall, the Washington Monument grounds and near the Reflecting Pool to celebrate the powers of sunshine, a popular topic at this time of year. Smithsonian museums, the Department of Energy and the Department of Housing and Urban Development will stage coordinated events. Kite flying, concerts, displays, bicycle races, workshops on architecture and solar inventions, and speakers Barry Commoner and astronaut Owen Garriott are all on the schedule.

Man Belongs to the Earth
A spectacular free film at the Air and Space Theater, shown at 5:15 and 6 P.M., May 3, was chosen especially for Sun Day.

The New Sun: Observations from Skylab
A free public lecture on studies of the sun from Owen Garriott's 59-day Skylab mission will be offered May 3 at 8 P.M. in the Air and Space Theater.

The Art of Rock: Micro Images from the Earth's Crust
The Museum of Natural History presents an exhibition of 30 photomicrographs of rock, polarized and magnified 50 times, beginning May 20 and closing July 9. The photographer, Othmar Tobisch, explains that color is captured through the rock as transmitted light, similar to light shown through stained glass.

Mrs. Jefferson Davis' Jewelry
The Museum of History and Technology is displaying the jewelry which marked the high points of Mrs. Davis' life, including an engagement ring, a cameo, a family necklace. Through the summer in the First Ladies Hall.

Wednesday Evening Jazz
The jazz ensemble of the U.S. Navy Band, the Commodores, will be playing on the terrace at the Museum of History and Technology from 6:30 until 8:30 P.M. May 3, 10, 17, 24 and 31.

Recent Acquisitions at the National Collection of Fine Arts
A selection of prints and drawings acquired during the past two years, including John Sloan's *Bathers* and Larry Rivers' *Study for 15 Years,* opens May 5, continues through summer.

Craft Multiples
This show of fine craft items, organized by the Renwick Gallery, will be on view in Corinth, Mississippi, at the Northeast Regional Library from May 13 through June 11.

Division of Performing Arts
- The Music of J. S. Bach will be performed on harpsichord by John Gibbons in the Hall of Musical Instruments, the Museum of History and Technology on May 1 at 8:30 P.M.
- American Country Music of James Talley is scheduled for Baird Auditorium, Museum of Natural History, May 7, 8 P.M.
- Benny Carter, jazz composer and arranger, plays trumpet and saxophone at Baird Auditorium, May 14, 8 P.M.
- The Smithsonian Chamber Players perform works by Haydn and Mozart in the Hall of Musical Instruments, May 15, 8:30 P.M.

Musical Weekend in May
The Seventh Annual Musical Weekend in Washington, sponsored by the Division of Musical Instruments and the Friends of Music at the Smithsonian, will be held May 12, 13 and 14. Reservations are being accepted for this event, which opens with cocktails and dinner in the historic Smithsonian castle, followed by a performance of the New York City Opera.

Hotel accommodations for two nights and meals are included. For information, write: Musical Weekend, Room 4123, Museum of History and Technology, Washington, D.C. 20560.

Continuing events

Expanded dining opportunities
- The Hirshhorn's popular outdoor café is open now for lunch and snacks.
- An enlarged menu is available this season at the outdoor luncheon facilities on the terrace at the Museum of History and Technology.
- The Museum of History and Technology has also recently begun serving a daily unlimited buffet brunch in the cafeteria.

New Sounds
from The Smithsonian Collection of Recordings

A lively and unusual jazz reissue:

John Kirby: The Biggest Little Band, 1937-1941

Bassist Kirby's sextet has been overlooked in histories of American music; but at its height it was not only popular—with two network radio shows, and hits such as *Undecided*—but musically daring as well. These 32 selections move from the band's informal beginnings through its later more intricate compositions, including adaptations of "classics" by Schubert.

$9.99 A 2-LP Set, ($9.00—Associates)
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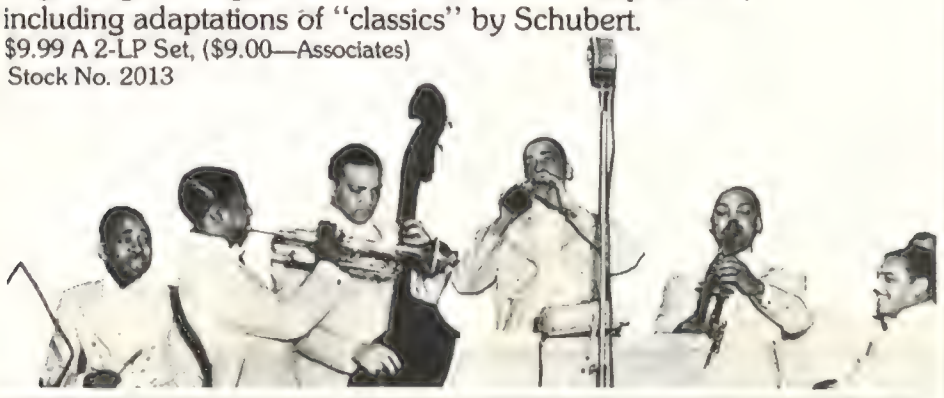

And . . . the recording debut of a favorite Smithsonian performer!

Orchestrion: The Magnificent Music Machine

Currently performing in the Smithsonian's Centennial Exhibit, this automatic orchestra is one of a few dozen Welte orchestrions in existence today. With 341 pipes in eight ranks, this talented music maker is heard here playing ten selections ranging from *Carry Me Back to Old Virginny* to Liszt's *Hungarian Rhapsody.*

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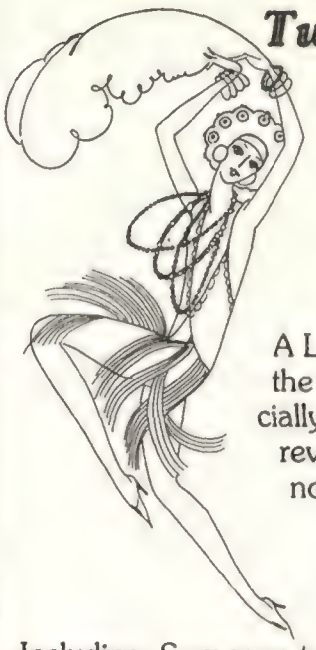

Two premieres in the American Musical Theater Series:

Oh, Kay!

A Long Island bootlegging operation is the setting for this musical written especially for Gertrude Lawrence. Frequently revived, this popular Gershwin show is now available in a 1926 edition—with performances by Lawrence, Gershwin, and duo pianists Arden and Ohman.

Including: Someone to Watch Over Me • Do, Do, Do • Clap Yo' Hands • Maybe
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Souvenirs of Hot Chocolates

Featuring music composed and performed by Fats Waller, this all black revue marked the Broadway debut of Louis Armstrong. Songs, comedy sketches, and dance numbers are all part of this elaborate nightclub-show-moved-to-Broadway.

Including: Ain't Misbehavin' • Sweet Savannah Sue • Black and Blue
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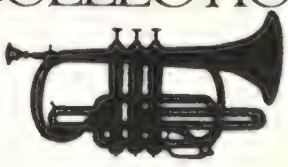

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Announcing a new Benefit for Smithsonian Associates

James Smithson's bequest "for the increase & diffusion of knowledge" is now an extended invitation to you to enjoy the incomparable resources of experts and collections at the Smithsonian Institution and the greater Washington, D.C., area. Join us in this new seminar series:

Horticulture: A Practical Approach to 18th-20th Century Gardening June 11-16
Illustrated lectures and tours of major horticultural sites in and around Washington, D.C., including the world-renowned DuPont estates of Longwood Gardens and Winterthur Museum Gardens; the Smithsonian, the National Arboretum, Hillwood Museum, Dumbarton Oaks, and U.S.D.A. with the horticulturist or landscape superintendent.

Our Dynamic Earth: From Diamonds to Plate Tectonics—June 11-16
Noted scientists discuss 4½ billion year old meteorites to the latest rock discoveries on the moon and Mars; present volcanic and earthquake activity; current theories of continental drift. A whole day on the finest collection of gems in the U.S. including the legendary Hope Diamond. Participants also enjoy a geological field trip to beautiful Shenandoah National Park.

A Look At Modern Sculpture—June 18-23
Lectures, tours, and films given by the professional staff of the Hirshhorn Museum and Sculpture Garden on renowned works of many great 19th-20th century artists in its diverse and excellent collection.

China: A Cultural History—June 18-23
The history of Chinese civilization from its prehistory to the enigmas of today, with emphasis on intellectual, artistic, and architectural traditions and the great philosophies and religions. Recent movies supplement tours of the outstanding collection of the Freer Gallery of Art.

Coming in the Fall . . . .

A Grand Tour of the Solar System—September 10-15
An astronaut and leading scientists in planetary exploration at NASA and the Smithsonian share their new knowledge using spectacular slides and films made during the planetary missions and the Apollo program. Includes activities at the National Air and Space Museum and Goddard Space Flight Center.

Connoisseurship of American Antique Furniture, 1650-1840 September 17-22
Masterpieces as great works of art placed in historical and cultural perspective. Also includes furniture fakes, care and repair of antiques, and visits to great collections.

From Flights of Fancy to Kites and Cosmos: A History of Flight October 1-6
The National Air and Space Museum's staff of experts uses its rich collections to share the latest insights on the history of aviation from the earliest attempts at flight to the advanced space technologies of today.

Genealogical Research: How to Do It October 1-6
Taught by the Dean of American Genealogy, Milton Rubincam, and by James D. Walker, Marilyn Duncan, and other leading authorities, participants learn how to conduct research in major repositories such as the National Archives, Library of Congress, and D.A.R. Library.

Write **Selected Studies,** National Associate Program,
A&I 1280, Smithsonian Institution, Washington, D.C. 20560,
or call (202) 381-6435 for details.

Expand Your World at the Smithsonian

• Brunch for Associates has been rescheduled on a daily basis in The Court at the Museum of Natural History.

Ronald Pearson: Silver and Gold
The Renwick Gallery is now exhibiting the metalwork created over a 30-year period by this noted craftsman, who has recently designed a silver flatware pattern called "Smithsonian." The show runs through July 9.

Kin and Communities Offers a Bit of History
The opening addresses of the Smithsonian's sixth international symposium, "Kin and Communities: The Peopling of America," are being offered on tape cassette and include one of Senator Hubert H. Humphrey's last major addresses. The cassette can be purchased for $7.50, plus 50 cents for mailing, by writing: Kin and Communities, Smithsonian Institution, P.O. Box 1641, Washington, D.C. 20013.

Radio Smithsonian

Listen for announcements of the Smithsonian-produced radio programs which run weekly on stations across the country. During the week of May 7 "Subways Around the World" will be a featured topic, and during the week of May 14 a discussion of the exotic costumes of Srinagar. During the week of May 28 Radio Smithsonian features a program on the designs of Frank Lloyd Wright.

Extended summer hours

During the Summer most Smithsonian museums will keep their doors open later in the evening. The 10 A.M. until 9 P.M. schedule applies to the Smithsonian Institution Building, Arts and Industries, the Hirshhorn, National Air and Space Museum, Museum of History and Technology and National Museum of Natural History. The Freer, Renwick, National Portrait Gallery and National Collection of Fine Arts will be open from 10 A.M. to 5:30 P.M. The National Zoo buildings will be open from 9 A.M. to 6:30 P.M.; the grounds 6 A.M. to 8 P.M.

Smithsonian Institution Traveling Exhibition Service

For information on SITES, write: Eileen Harakal, Smithsonian Institution, Wash-

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Five years ago the publishers of Forbes Magazine began offering for sale a portion of their 260-square-mile Trinchera Ranch in five acre minimum sections called Sangre de Cristo Ranches. More than 95% of that land has been purchased to date. Sangre's success exceeds all expectations.

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Cash prices range from $3,500 to $12,000. Easy credit terms are available.

Forbes Park is a completely private area surrounded by the San Isabel National Forest and the rangelands of the Trinchera Ranch. It is accessible year-round through a main gate restricting entrance to owners and their guests. Hunting is not permitted here, but many sports including fishing, cross-country skiing, boating, swimming, horseback riding, tennis and mountain climbing will be available in the recreational areas of the vast common acreage.

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For complete information, including pictures, maps, and full details on our liberal money-back and exchange privileges, without obligation, please fill in the coupon or card and mail to: Forbes Park, Box 303, Fort Garland, Colorado 81133.

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Exploring the World with the Smithsonian

For both the seasoned and would-be traveler, the Smithsonian has developed a travel program to meet a variety of tastes and budgets. In order to accommodate the increasing growth and interests of Smithsonian Associates, the tour programs have expanded, bringing travelers to places reflecting the Institution's interests.

Three types of trips are available, Charter, Domestic and Study, each with its distinct character. Foreign Study Tours provide small groups with culturally oriented, specialized trips, under the guidance of museum curators or experts in respective fields. Foreign Charter Tours, consisting of several small groups under the leadership of skilled guides and interpreters, are lower in cost, combine study, discovery and vacation. Domestic Tours offer specialized guidance and expertise generally unavailable to persons traveling on their own.

Foreign Charter Tours

Paris and Provence*—September 4-18: Paris plus Avignon, Arles, Nîmes and Aix-en-Provence; museum seminars at the Louvre and the new Pompidou center; walking tours of the islands of the Seine; excursions to the Loire region, Chartres or Reims.

Scotland*—September 25-October 9: Edinburgh and beyond—a program of walking tours and special visits in Edinburgh: castles, abbeys, battlefields, archaeological sites, plus incomparable scenic beauties of rugged mountain glens and rolling hillsides through the Highlands and Lowlands of Scotland.

Japan—November 5-21: The heart of historic Japan with an extended program in Kyoto and Nara followed by choice of travel seminars to the Inland Sea, the Sea of Japan or Kyushu. Conclude in Tokyo with visits to Nikko or Kamakura. Visit ancient temples, castles and shrines with expert study leaders. (Originates and ends in San Francisco.)

New Zealand and Fiji—November 17-December 5: Departing Los Angeles, this tour includes Mt. Cook, Te Anau and Milford Sound, plus Auckland, Rotorua, Wellington and Christchurch. Included will be talks on New Zealand's natural history, Maori heritage, parliament, plus a home visit. Brief rest stop at Fiji before return flight to the West Coast.

Winter Russia*—December 28-January 11, 1979: Leningrad, Tallin and Moscow plus optional two-day excursion to Vladimir and Suzdal; attend special winter festivities including gala New Year's Eve party; life-seeing visits to schools, factories or clinics; attend Russian theater and circus.

Low cost of tours includes first-class hotels, most meals, sightseeing, lectures, theater tickets and air fare. *Optional predeparture course will be available. Write Smithsonian Associates Travel Program, A&I 1278, Smithsonian Institution, Washington, D.C. 20560 or call (202) 381-5635 for brochures on specific tours.

Domestic Study Tours

Shenandoah Mountains—June 3-10: Study the geology, archaeology, natural and social history of these beautiful Virginia mountains. Tour originates in Washington with an orientation talk at the Smithsonian.

High Sierra Camping—July 15-24: Explore California's Sierra Nevada by four-wheel drive vehicle; learn how the bristlecone pine has survived as the oldest living thing. Spectacular scenery for hikers.

Desolation and Gray Canyons—July 23-August 2, September 29-October 9 or October 10-20: White-water trip for the adventurous; explore the geology, wildlife and Indian and outlaw history of Utah's Green River.

Wind River Mountains—July 29-August 6: A horseback trip into the land of mountain men. Camp at 10,000 feet among turquoise lakes and high-meadow wild flowers.

Williamsburg Family Weekend—August 10-13: A repeat of our popular program for children ages 7 through 14 (and their parents) to learn about 18th-century life through participation in special tours.

Winterthur and the Brandywine Valley—August 12-20: Focusing on architecture, furnishings and decorative arts, visit the world-renowned collections at Delaware's Winterthur Museum. Explore the restored 18th-century towns of the Brandywine Valley and Maryland's Eastern Shore.

Grand Canyon—August 18-28 or August 25-September 4: An exciting raft trip through the Grand Canyon with emphasis on ecology and history.

Canadian Rockies—September 7-17: Discover Alberta's scenic beauty and natural wonders on daily hikes at Lake Louise and Banff Springs. Meet in Vancouver for an overnight train trip to Lake Louise.

Toronto—September 19-25: Special program of museum lectures and walking tours to experience the exciting diversity of this city's art and architecture. Also visit Stratford Shakespeare Festival and Niagara Falls.

Weekend at the Hirshhorn Museum and Sculpture Garden—September 22-24: A weekend devoted to the Hirshhorn's exemplary collection of 20th-century painting and sculpture, with films, walking lectures and discussions.

Mesa Verde and Chaco Canyon—September 24-October 2: Enjoy autumn colors in the Southwest while learning about the history of the Pueblo Indians through visits to important archaeological sites and Canyon de Chelly, Arizona.

California Wine Country—October 1-7: From San Francisco, visit selected vineyards in Napa, Sonoma, Santa Clara and Monterey with wine tasting and special lectures by vineyard owners and discussions with wine masters.

Illinois Archaeology—October 14-21: Join archaeologists in the excavation of an Illinois River valley site spanning almost 10,000 years. Actual digging will be supplemented by instruction, lectures, laboratory work and field trips.

Washington "Anytime" Weekend: Choose any weekend to visit the nation's capital and enjoy a special tour of the original Smithsonian building, spend two nights at Loew's L'Enfant Plaza Hotel close to the Mall, and see other sights in Washington by Tourmobile. Reservations and payments must be received at least ten days prior to arrival date ($59.95 per person, based on double occupancy).

Brochures on specific tours are available. For information, write Smithsonian Associates Travel Program, A&I 1278, Smithsonian Institution, Washington, D.C. 20560 or call (202) 381-5635.

Foreign Study Tours

Thomas Jefferson in England and France—July 9-30: His travels are retraced, with emphasis on country houses and gardens he admired; led by Professor Frederick Nichols of Charlottesville.

Iraq and Iran—October 30-November 25: Fly from New York to London, visit Mesopotamian collection in the British Museum, then to Iraq for Baghdad, Babylon, Ur, Nineveh and historic sites. In Iran, visit Tehran, Shiraz, Persepolis and Isfahan. Return via London to New York.

For detailed information, write: Miss Bliss Schumann, Foreign Study Tours, S.I. 123, Smithsonian Institution, Washington, D.C. 20560 or call (202) 381-5520.

ington, D.C. 20560, or call (202) 381-6631.

• San Francisco, California—"James Weldon Johnson" traces the major events in a life dedicated to the pursuit of racial justice, at the San Francisco African American Historical and Cultural Society, through June 1.

• Phoenix, Arizona—"Canyon Graphics and Graffiti," at Entz-White Lumber and Supply Company, May 6 through June 4.

• Shreveport, Louisiana — "American Drawings 1976" will be on display at Meadows Museum from May 6 through June 4.

• Chicago, Illinois—"American Eagle: Symbol for Survival," will be shown at Financial Shares Corporation from May 6 through June 4.

• Logan, Kansas—"Antarctica," a pictorial visit, will be exhibited at the Dane G. Hansen Memorial Museum from May 27 through June 25.

• Midland, Michigan—"Biological Photography" is opening at the Grace A. Dow Memorial Library on May 27.

• Bountiful, Utah—"Tropical Blossoms" will be displayed at the Bountiful Art Center from May 6 through June 4.

• Wausau, Wisconsin—"Hungarian Art Nouveau," including graphics and sculpture, will be shown at Leigh Yawkey Woodson Art Museum May 2 through June 11 (see below).

Engaged Couple in Wausau, Wisconsin

When visiting the Smithsonian

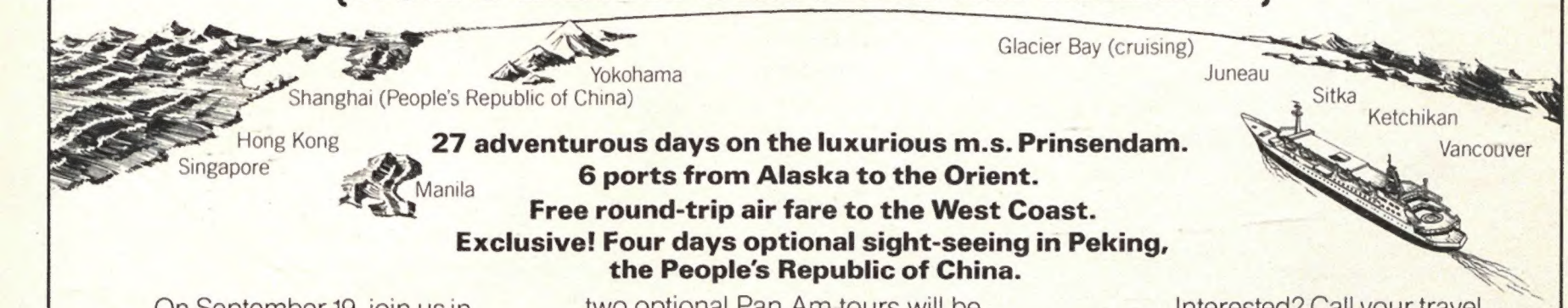
Members are invited to register with the Associates receptionist in the original Smithsonian Institution Building—the old red castle on the Mall. Here, between 10 A.M. and 4 P.M. daily, members may receive special orientation materials to ensure a more enjoyable visit, and may relax in the Associates Lounge. Misplaced membership cards will be duplicated upon presentation of a SMITHSONIAN magazine address label. To aid in trip planning, members are encouraged to send a postcard or phone for an information packet: Associates Reception Center, Smithsonian Institution, Washington, D.C. 20560; (202) 381-6264.

The Court

Served every day of the week in The Court, a buffet-style restaurant for Associates only in the Museum of Natural History: Brunch, 8:30-11 A.M. (entrance via Constitution Avenue), $2.95 for adults and $1.95 for children; lunch, 11 A.M.-3 P.M., $3.95 for adults, $2.95 for children; dinner, 4:30-7 P.M., prices same as at lunch.

Alaska, Shanghai, Singapore, Japan... and Peking.

(How's that for a fabulous fall vacation?)



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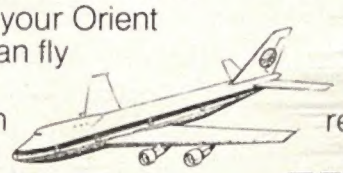

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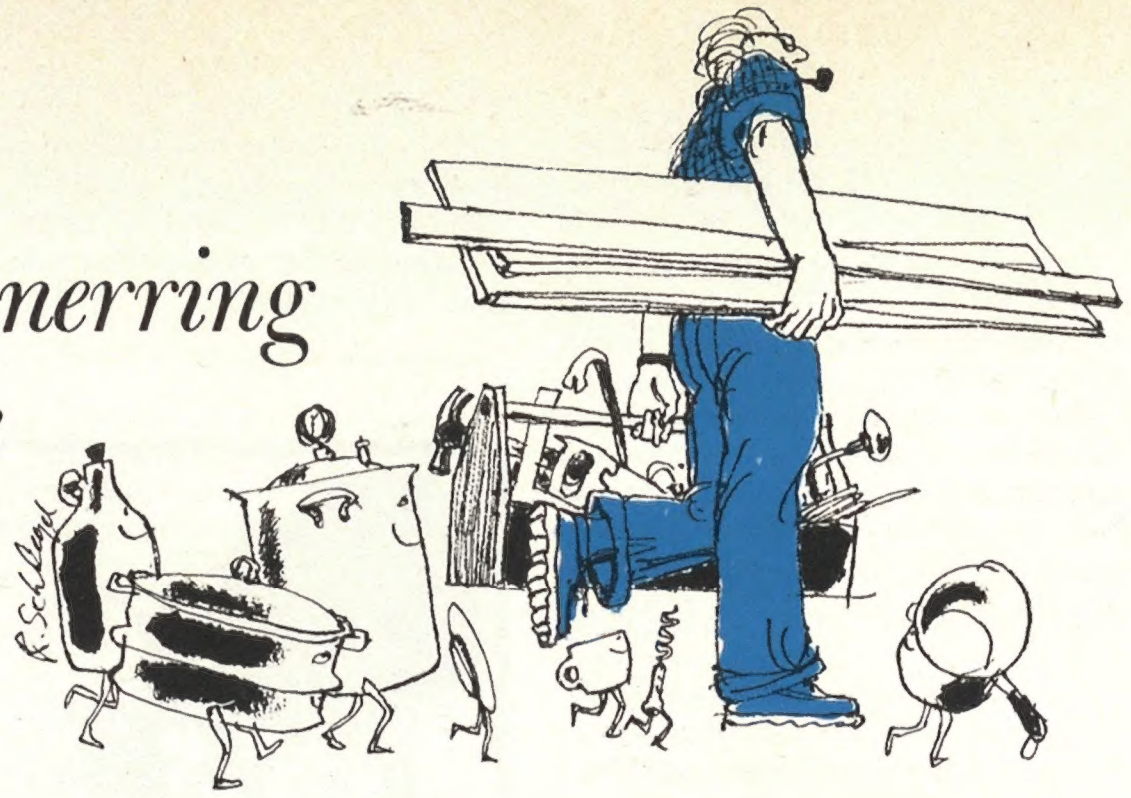
By Patrick Ryan

Pots and pans, unerring grabbers of space



A responsive chord twanged in my memory as I listened to a BBC radio chat show graced by the presence of author and historian C. Northcote Parkinson. Mention of his famous Parkinson's Law ("Work expands to fill the time available for its completion") inspired another member of the panel to suggest that there was a domestic extension of that law, which ordains that "objects expand to fill the space available"—a canon exemplified by the fact that whenever you put up a new shelf, it promptly becomes filled with things you didn't know you had.

This expansive phenomenon is particularly active in the kitchen where, within a week of adding yet another storage cabinet, you invariably find it bursting, and you're just as short of space as ever. Long-forgotten utensils, redundant pickle jars with built-in forks, and that Spanish majolica donkey bearing condiments in its panniers, all of which used to pig it together in some remote corner, now magically emerge and take up residence in the new cabinet, each and every one with Lebensraum to spare.

I have long been perplexed by the household enigma of just how our workaday items of equipment find such peculiar places for themselves. When gallant guests help to clear up after a party, the eye-level oven and the high-rise fridge reverberate to cries of "Where do you keep your place mats?" and "What shall I do with the lemon squeezer?" Each kind helper knows where the queried article lives in her or his own home, but also instinctively knows that in your kitchen it resides someplace else.

Few more panic-striking plights have come my way than when fate has called upon me to cook alone and without maps in a strange kitchen. The overwhelming helplessness as you open drawer after drawer, in the hope of finding something more surgical than a grapefruit knife for slivering up beef stroganoff, can only be compared to that experienced by an astronaut with all systems gone, drifting off into unending space.

Hasty psychologists might claim that housewives keep the tools of their trade in the same place as did their mothers, since such locations would have been imprinted on their minds during infant years about the maternal kitchen. But my personal research indicates that such is a false presumption. My wife has two equally married sisters. On the matriarchal inheritance theory, their kitchen disorganizations should be similar. Not so. In each of their houses, the seating arrangements for pots and pans and crockery are utterly different.

Take the humdrum saucepan as an example of raving diversity. The younger hangs up her saucepans on hooks on the wall; the elder has a nesting system in which, in descending order of diameter, each pot rests inside another, thus raising a seven-piece, aluminum Tower of Pisa. My wife, the middle sister, keeps the lids on all her saucepans and scatters them horizontally so that they take up the maximum possible space and precipitate kitchen extensions.

Assisting guests should never use their own initiative in other people's kitchens. Number One sister is inclined to adopt such imperious tactics when visiting us, possibly feeling it beneath her primogenital dignity to admit ignorance to her juniors. When she doesn't know where we keep something, she just sticks it back in the same place as she keeps it in her own kitchen. With the result that, after she has departed, we sometimes lose track of vital cooking implements for days on end. We once had to phone her in alcoholic panic when she cut us off from the bottle opener. We never dreamed that she kept hers on the top shelf of the broom closet.

Simple husbands sometimes foolishly query the peculiar places which kitchen utensils acquire for themselves. I once so questioned the siting of our salad bowl. It lives as the only wooden object in a bottom cupboard stacked with ovenware, and acts as a bookend to a stack of 11 vertically filed muffin pans. Whenever you take the bowl out, all the pans come clattering down.

"Why," I asked my wife, on one such jangling occasion, "do you keep the salad bowl down there?"

"Because," she said with devastating finality, "that's where it goes."

The salad bowl had made its choice. Human inconvenience is of no significance. I was about to delve deeper into this riddle when my wife sharply suggested that before I started criticizing the layout of her kitchen, I should go outside and contemplate the superb disorganization of our male-dominated double garage, which is so cluttered with redundant junk that even our single car has to stand outside.

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